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NOTICE.

Mr. E. F. Ingraham, formerly manager of THE ELECTRICAL WORLD'S Philadelphia branch office, is no longer connected with this paper.

AN ingenious method of wiring buildings for annunciators is described in another column. By this means also the number of magnets on the annunciator board is considerably reduced. In large buildings the use of this method may lead to considerable saving.

A MEETING of the Executive Committee of the National Electric Light Association will be held in this city, at the Hotel Dam, on the 11th inst. Mr. De Camp, the chairman of the committee, is desirous that the attendance shall be full, as there is important business to transact, and we therefore give prominence to the announcement.

IT is announced that the second annual meeting of the American Institute of Electrical Engineers will be held on the 18th inst. Officers will be elected for the ensuing year, and papers are promised on such important subjects as recent progress in telephony, incandescent lighting from central stations, patent office practice, secondary batteries for light and power, subterranean electric systems, and static difficulties in multiplex telegraphy. This is an attractive programme, and may be added to. We hope the attendance will be large, and that the Institute will be able to enter upon the third year of its existence with brighter prospects and a larger membership than it has yet known. The Institute can, if properly supported, be of immense service to science, and deserves the support of all electrical students and practitioners.

WE know of few electrical applications that present for solution so many problems of a complex nature as the telephone in the line of its utilization by the public. Even assuming, as we may, that the Bell Company will enjoy a monopoly until its original patents expire by natural limitation, it is very likely that the existing systems of service will undergo radical change in the interval, so as to meet new conditions and requirements. For example, the method of obtaining revenue from exchanges can hardly be looked upon as settled, and we still have various systems on trial. An article in this issue describes the practice on the Pacific Coast, where a system is in vogue that guarantees the exchange a good income and at the same time gives service on the basis of payment by results. It appears to work well, and its success may be inferred from the absence of complaint as to extortionate rates. The article will be additionally interesting if taken in connection with Mr. B. E. Sunny's valuable paper on telephone statistics, read last year before the National Telephone Exchange Association. Mr. Sunny did not give any information then regarding California, but the figures and facts we now present will help to emphasize his remarks on the anomalies and inequalities revealed by a study of the telephone statistics of various parts of the country.

THE report of the Commissioners of Electrical Subways in response to a resolution of inquiry of the Senate, we give in full in another column. It is quite a diplomatic production, in that while apparently attempting to satisfy the curiosity of the prying Senate, it gives no clue to the future action of the commission. Probably, the unfortunate death of one of the members made it inexpedient to enter as fully into the question as would otherwise have been done, and as the report truly says, no definite action can now be taken until the new commissioner is appointed. We are glad to note that the commission fully realize that "the difficulties which surround the successful solution of the underground wire problem in this city are of an extent and magnitude of which the public, as voiced in the general press at least, have no adequate comprehension." In this expression we recognize, for the first time, that the commissioners are conscious of the responsibility which rests upon them, and we trust they will act accordingly. As regards the appointment of the new commissioner, we think that the opportunity is now offered of enhancing the value of the work by the appointment of an "engineer-commissioner," the absence of whom we deplored at the first announcement of the commission. The most important part of the work is probably performed, and so we await the final dictum which, it is claimed, will very shortly cause the effodient ceremony to be performed upon the wires that have so long braved the weather and the indignant householder.

QUITE recently these columns have contained notes in regard to the uncertainty which still exists regarding the nature of the forces at work in the electro-motor, and we have looked forward to the time when a clear and comprehensive theory of the motor would be formulated. We are happy to announce that one great step has already been made in the direction in the enunciation of a clear and concise definition of what an electric motor is. Evidently, unless we know exactly what manner of thing we are trying to find a theory for, we can hardly find one. Many students will, therefore, hail with delight the following definition of the motor offered by a Kansas City scientist to the local Query Club. According to him "the current of electricity generated in the revolving coils of the armature of a dynamo is conducted from the machine through metallic brushes which rub against a device called a commutator and collect the electricity as it is generated. *Replace the permanent magnets of such a machine with soft iron pole-pieces (which do not retain magnetism), and you have a motor.*" Now, could anything be clearer than this? There are no highly scientific terms embodied in it to bother the brains of aspiring electricians; there is no mention of reversibility, efficiency, etc.; everything is expressed in plain and unmistakable terms which any schoolboy can understand. This definition may be objected to on the score that it does not conform to that heretofore accepted; but this is an era of progress, and of advanced ideas; and, although the author may be a little ahead of his time, that is no reason why his definition should be rejected. Let it stand by all means, if not for a classic expression, at least for a warning to all hearers of amateur lectures.

THE Pan-Electric inquiry has proved an exception to the usual Congressional investigation by gaining in interest and excitement as it proceeds. The passages of arms between committeemen and witnesses have been numerous and sensational, and at least one gentleman went so far as to suggest that nothing short of a duel could satisfy his wounded pride and honor. Aside from talk about pistols, however, the inquiry has been full of notable episodes, and has brought out some very striking evidence. To us, the quiet little colloquy in which Professor Bell told the committee how, when he invented the telephone, he gave his wife an interest in it that is worth ten million dollars to-day, seems quite dramatic, in view of the singular chain of circumstances leading up to the invention. In fact, the evidence given by the chief holders of Bell stock, as reported in our pages this week, tells a story the like of which is almost without a parallel in modern science, invention and commercial development. Probably the telephone business would have grown apace after the introduction of the instrument into general use in 1877, but its fruitfulness in the financial sense is certainly shown to be due to the keen sagacity that has throughout directed the affairs of the parent company. As to the main lines of the investigation, it has been made pretty clear that the expressions of newspaper opinion adverse to Pan-Electric officials have been honest and spontaneous, and that there were a good many men in Congress who were able to resist the seductive influence of the Rogers brand of poetry and stock. The Pan-Electric scandal will not soon be forgotten.

FOR some little time past, the New York *Times* has been making charges, or insinuations, to the effect that the Bell Company had hired newspapers in this city to take up its defense in regard to the Government suits. No evidence in support of these charges has been discoverable, but, on the other hand, it has come out that the *Times* itself received $1,200 for an "industrial article" four columns long, in favor of the Bell Company, last January. Its esteemed contemporaries have therefore turned on the *Times* their ridicule and sarcasm, and now in revenge accuse it of shameless impudence and venality. The truth of the matter is that the *Times* printed the article in question as advertising, and was paid for it as advertising. The same number of the paper in which it appeared contained articles of a like nature in favor respectively of the Molecular and Wallace telephones, as opposed to the Bell; and there were, moreover, several other articles on electrical firms or specialties. All these articles, from first to last, were "starred" to indicate that they were not a part of the regular reading matter; and at the time of their publication our idea was that the *Times* had carefully gone over the advertising pages of THE ELECTRICAL WORLD and picked out for canvassing some of the best concerns. Of course the *Times* is at liberty to sell its advertising space in any way it pleases, and we do not think it fair for the other dailies that adopt like practices to attack it on any of the grounds yet urged. Our own opinion on the subject is that no self-respecting paper will print advertisements at all under the guise of reading matter, and that the *Times* is open to criticism because, on the granted supposition that the matter was advertising, it gave up four of its columns to a company that it holds to be "an insolent corporation" built up on "a fraud." No paper should open its columns to frauds on any excuse whatever.

THE relative working values of the materials used in primary batteries would appear to be a very timely topic at present, when much is being done to satisfy a demand for domestic electric lighting where a dynamo current cannot be obtained. Our columns in this issue contain a comparison of the principal materials which are employed at present or have been proposed, and a study of the figures may help to throw some light upon the results which are claimed to have been obtained with some forms of primary battery. While materials differ greatly in value from the electrical stand-point, it must not be forgotten that they also differ in cost, and hence the question of economy enters here as it does in all similar problems. It is evident that if one battery material had twice the working value of another, but on the other hand cost three times as much, weight for weight, the poorer material would still be the more economical, though theoretically not the most efficient. The ratios of the economical values, however, are continually changing, for as new processes of manufacture of the chemicals are discovered, the cost is reduced, and they can be economically employed in comparison with older and heretofore cheaper materials. This has, we believe, recently been the case, in one instance, viz., that of chromic acid, which, as the table shows, possesses a high working value. In all forms of bichromate cells it is in reality the chromic acid which is the active agent and which in the old form of battery is set free by the action of an acid, usually sulphuric, which is added to the bichromate for that purpose. By the use of chromic acid direct the electrical action is not only facilitated, but a greater quantity of active material can be placed in the same space, and the formation of deleterious by-products is prevented. The same article also draws attention to the peculiar action which takes place in the battery in which mercuric chloride is employed, with chlorine as the active agent. Such a regenerative action, as it may be called, is a most curious variation from the general rule, which is rather the reverse. Local action, as a rule, is deleterious, but in this case it would appear to be a benefit.

Official Report on Underground Wires in New York.

The subjoined is the report of the Commissioners of Electrical Subways of New York City to the Senate of the State of New York:

In compliance with the resolution passed by you April 19, instant, we, the undersigned, comprising the Commission of Electrical Subways for the City of New York report as follows:

With regret we first refer to the death of our colleague and President, Mr. Charles E. Loew, and it may not be inappropriate to add in this connection that in his death the Commission has lost a member of exceptional executive ability, and one who apparently was animated by the controlling object of selecting a system best suited to the requirements of the public, and of the electric companies.

We formally organized as a board July 20, 1885.

All corporations, private companies or persons on record as controlling or operating electric conductors in the City of New York were then immediately notified to file with us, within sixty days, as stipulated by the statute, maps or plans illustrating such underground systems as they would desire or prefer to construct and operate. Within that time but one response was made to this call, namely, that of the Metropolitan Telephone and Telegraph Company. But as their proposal did not refer to the general or inclusive use of any or all classes of electric conductors, being specifically applicable to telephonic service only, we could not regard it as coming within the scope contemplated by the law. Therefore it devolved upon us to act under the alternative provisions of the statute, namely, to select, devise or cause to be devised such a general plan as would meet the requirements of the act, and cause the same to be constructed "as soon as might be consistent with the convenient use thereof by the public," and to this end we have since been actively engaged, as will hereinafter more fully appear.

The following tabulation showing the mileage of wire now operated in this city is based on the statements made to us by the electric companies:

	Overhead.	Underground.
Telephone	5,446 miles.	614 miles.
Telegraph	5,981 "	186 "
Electric light	431 "	56 "
Messenger service	1,099 "	
Stock quotations	389 "	
Miscellaneous	300 "	
Police telegraph	60 "	
Fire alarm	850 "	150 "
	14,556 miles.	1,006 miles.
Underground	1,006 "	
Total miles	15,562	

It is safe to assert, however, that an actual survey might considerably change this showing.

Inventors, electricians and engineers generally were invited by six days' public advertisement to submit plans and proposals pertinent to the subject, the individual incentive to which was the chance of adoption of a system from those presented.

In reply to this invitation 118 different plans have so far been submitted, of which, up to the time of Mr. Loew's illness, 105 had been classified and officially passed upon. Opportunity was frequently given to inventors, experts and promoters of these plans, and also the representatives of the electrical companies, to orally describe their plans and express their views.

The underground systems of Philadelphia, Washington and Chicago were personally examined by us during November of 1885—or rather such embryo systems as there exist.

After having thus exhaustively taken up the different branches of procedure which under the law and to the best of our belief and ability seemed to promise the best results, we finally convened for conclusive action late in December of last year, and but for the untimely illness and death of our colleague we would undoubtedly ere this have reached a unanimous conclusion. Our future action, however, will now wait upon the appointment of his successor, to whom the results of our investigation will be submitted.

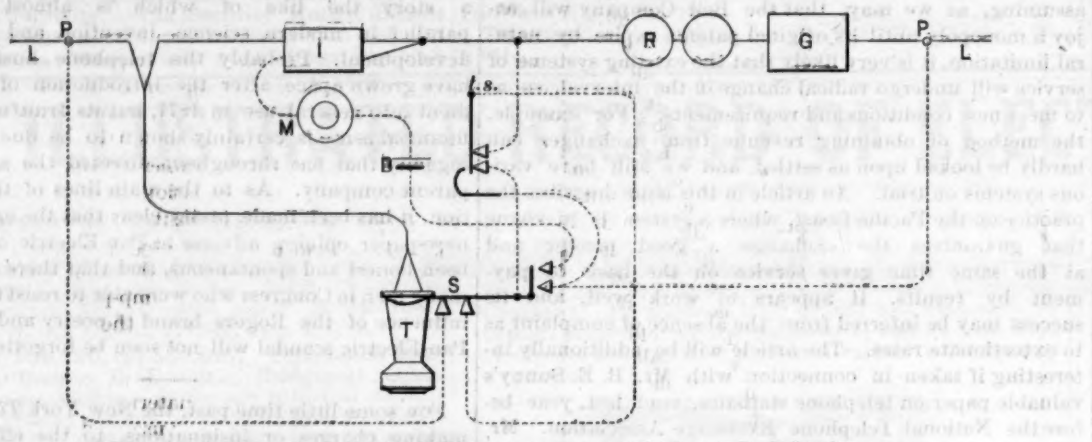


FIG. 1.—NEW ARRANGEMENT FOR TESTING TELEPHONES.

The difficulties which surround the successful solution of the underground wire problem in this city are of an extent and magnitude of which the public, as voiced in the general press at least, have no adequate comprehension.

But it does not appear to us within the requirements of your resolution or the province of this statement to exhaustively go over the ground technically or otherwise, except that we are prepared to say, as a matter of belief due to our investigation and study of the subject, that we shall be able, within a reasonable time after the present vacancy in our board is filled, to submit a comprehensive plan of a system which will prove satisfactory to the public, not prohibitory or ruinous to the electric companies and creditable to ourselves. Our action, at least, shall be due to the best comprehension of and judgment upon the subject of which we are capable, as to act with less than complete confidence in the outcome would appear to us as rash and unwise.

New Arrangement for Testing Telephones.

In the ordinary telephone with its magneto, the difficulty of locating a fault developed causes frequent delay and entails considerable work. In the "Chicago telephone," made by the Western Electric Company, a novel feature introduced is a test key, in connection with the magneto and ringer, by means of which the magneto current is made available for testing for all the faults which may develop.

Another feature is the arrangement of the circuit and switch connections to prevent interruption and failure of the magneto, because of dirty switch contacts. The arrangement employed effectually provides against interruption of the circuit, even though the switch should fail to make any contact. This result is accomplished by placing the ringer, generator, induction coil and hand telephone directly in the circuit of the magneto, and connecting the switch and its contacts so as to shunt or short-circuit the ringer and generator, or the induction coil and hand telephone, accordingly as the switch is up or down.

The three accompanying diagrams, Figs. 1, 2 and 3, illustrate the magneto circuits in connection with the microphone and hand telephone. In the diagrams *L L* are the line connections, *P P* the binding posts of the magneto, *G* the generator, *R* the ringer, *I* the induction coil, *M* the microphone contacts, *B* the local battery, *S* the telephone switch, *T* the hand telephone and *t s* the test switch.

Fig. 1 shows the usual arrangement of the magneto when connected in line with the telephone on the hook, not in use. Fig. 2 shows the apparatus of the magneto in position for the first test, with the line wires disconnected, the test key *t s* depressed and the hand telephone on the hook. Fig. 3 shows the apparatus in position for the second test, the lines being disconnected, the test key *t s* depressed and the hand telephone removed from the hook.

The test switch is placed within the magneto, on the same side with and above the telephone switch; a perforation in the side of the box permits the introduction of a plug with which to depress the spring of the test switch into contact with the angle piece as shown in Figs. 2 and 3, in which manner the test circuit is established.

To test the magneto, an inspector has simply to disconnect the line wires from the binding posts of the magneto, insert the plug at the test switch depressing it, and turn the crank, *first* with the hand telephone on the hook; *second*, with the hand telephone removed from the hook. When the test key is thus depressed, the bell should ring whether the hand telephone be on or off the hook, and if it rings at each test, no "break" or "open" exists in the apparatus.

With the apparatus as shown in Fig. 2, a turn of the crank will cause current from the generator *G* to flow through the ringer *R*, thence through the secondary of the induction coil *I*, thence through the hand telephone *T* and its conducting cord, thence to one of the lower contacts of the switch *S*, to the switch and to the other lower switch contact, thence to the spring of the test key *t s*, and from the contact against which the spring is pressed to the binding post *P* and back to the generator. Upon making this test the bell should ring; a failure to ring indicating a break in the continuity of this circuit, as traced. To locate the break, the inspector, with a piece of wire, short-circuits first the secondary of the induction coil, then the hand telephone, then the lower switch contacts, ringing each time, until he has short-circuited the defective place, which will instantly be indicated by the ringing of the bell, and the fault may be corrected.

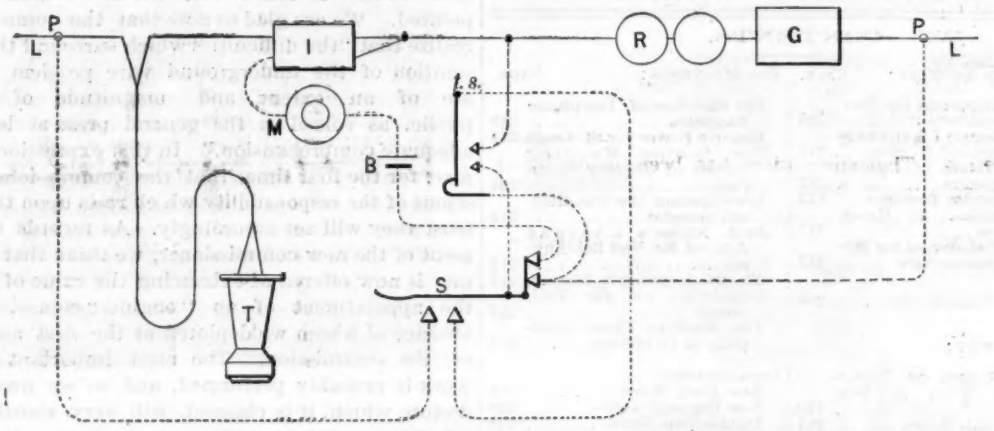


FIG. 3.—NEW ARRANGEMENT FOR TESTING TELEPHONES.

With the apparatus as shown in Fig. 3, a turn of the crank will cause the current from the generator *G* to flow through the ringer *R*, thence through the primary of the induction coil *I* and microphone contacts *M* to the local battery *B*, thence to one of the upper contacts of the switch *S*, to the switch, and to the other upper contact of the switch and thence to the binding post *P*, and back to the generator. The bell should ring at this test; a failure to ring indicates a break in either the primary of the induction coil, the microphone contacts, the local battery or the upper switch contacts. Short-circuiting the parts successively while turning the crank locates the break, the bell ringing when the defective point is shunted out.

In the above description, by "lower switch contact" is meant the contacts made by the switch lever *S* when the hand telephone is on the hook; by "upper contacts" is meant the contacts made by the switch lever *S* when the hand telephone is removed from the hook.

This arrangement evidently makes it very convenient to locate the "ills to which the telephone is heir," and covers probably every point which could arise in practice.

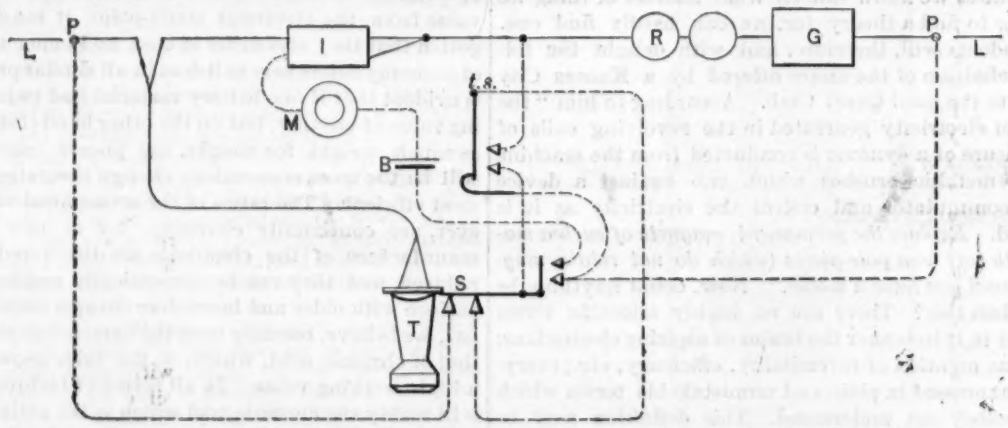


FIG. 2.—NEW ARRANGEMENT FOR TESTING TELEPHONES.

The Daft System in Missouri.—The Daft Electric Power and Light Company, of Missouri, has now filed articles of incorporation. The capital stock of the company is $300,000. The incorporators are Christian Peper, John Scullin, C. O. Godfrey and E. C. Rice, of St. Louis; T. D. Ripley and H. G. Bond, of New York City, and R. W. Hawkesworth, of East Orange, N. Y. A branch office will be opened in East St. Louis.

Cuts in Cable Rates.

In order to meet the cut in rates made by the "cable pool" the Commercial Cable Company has lowered its rates to 25 cents a word. It makes the following appeal to the public:

"The Commercial Cable Company was established for the purpose of affording a permanent competing and efficient service to the public at such tariff as would yield a moderate interest upon the capital actually invested, with no disposition to harm existing properties. Forty cents per word was therefore adopted, being a reduction of 20 per cent. upon the previously existing tariff. The public having hitherto extended to the company their hearty support, we have resisted the repeated importunity of the competing companies to join in a largely advanced rate of *sixty cents* per word. The result is the announcement now made of a reduction by the combined Anglo, Direct, French and Western Union companies from 40 to 12 cents per word. This means not only the destruction of all interest upon investment, but the conduct of the business at great cost in excess of gross earnings, and should the aims of the combined companies be accomplished, the losses incurred by them will be regained *from the public* by a largely increased tariff. The Commercial Cable Company has determined not to meet to its full extent the ruinous competition thus sought to be forced upon it, but offers to the public a rate of *twenty-five* cents per word on and after the 5th of May next. In the impending struggle the existence of an independent and competitive Atlantic cable service is at stake, and our patrons must now pronounce for or against its maintenance. They must decide for themselves whether it is in their interest to encourage monopoly by availing of a temporary tariff, which is certainly not designed for the public benefit, but for the purpose which cannot be disguised—namely, the destruction of the Commercial Company—or to continue to support an enterprise through whose operations they have already been so largely benefited. We therefore confidently anticipate the continuance of your support."

A large number of letters have been received at the office of the Commercial Cable Company from prominent bankers, brokers, and merchants, all declaring their intention to continue as patrons of the Commercial Cable regardless of the reduced price per word offered by the united cables in the war of rates now in progress. Good service and the belief that the Commercial Company is in earnest in its pledge to maintain independence prompted the support. It is not improbable that leading firms using the cable will join in a public declaration of their intentions in this direction. That suggestion has been made by a large importing house of New York.

Discussion of Mr Bernstein's Paper on Low-Resistance Incandescent Lamps.

An interesting discussion on the paper of Mr. Bernstein "On Low-Resistance Glow Lamps," read to the Society of Telegraph Engineers and Electricians, and recently published by us, was opened at the meeting of the Society by Dr. J. A. Fleming, who, like Mr. Preece at the preceding meeting, objected to Mr. Bernstein's use of the word "strain" to denote what is commonly called the efficiency of a lamp. Rankine has defined a strain as a displacement in opposition to a stress, and this meaning of the term has now become general in scientific treatises. It is tolerably safe to say that we shall hear no more of the newly proposed use of this perfectly definite word.

Dr. Fleming then passed to the question of the emission of light and heat from the filaments of incandescent lamps, and remarked that some filaments gave out a greater proportion of light rays, as compared with heat rays, than others; and of course for the purpose of lighting, the former filaments were desirable. Experiments are required in this matter to determine the causes of this result, and enable inventors more clearly to recognize what they should aim at in a filament in order to improve its photic emissivity. It is known that gray filaments are more refractory than black, sooty ones, and will therefore stand a higher temperature without giving way. Filaments are now made very fine, some of 900 ohms resistance, and the limit in this respect has not yet been reached. With regard to the disintegration of a filament in the vacuum, Dr. Fleming expressed the opinion that the forces at work were of a thermal nature. The vacuum in the bulb is a very high one, and the mean free path of the molecule is probably as great as the diameter of the bulb.

Mr. W. M. Mordey thought there was a field for Mr. Bernstein's system in working arc lamps and motors as well as glow lamps in series. He did not consider it likely to be much used on board ship, where the limits of an installation are so circumscribed. He pointed out that a 3,000-volt new Brush machine would drive a current of 10 ampères, as required by Mr. Bernstein, through 215 miles of

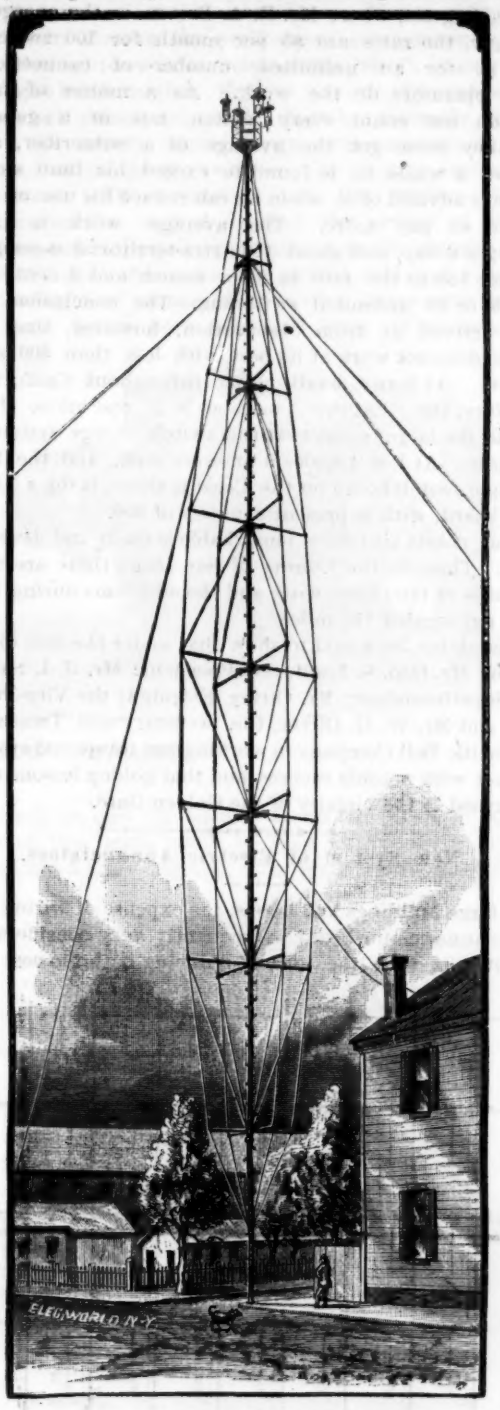


FIG. 1.—TOWER OF THE JENNEY ELECTRIC COMPANY.

No. 6 wire; and allowing 750 yards of this for every 6-volt lamp used, some 450 lamps could be lighted. An arc light could also be maintained in a light-house 210 miles from shore, provided the sea was used as an "earth," or 105 miles provided a return wire was used.

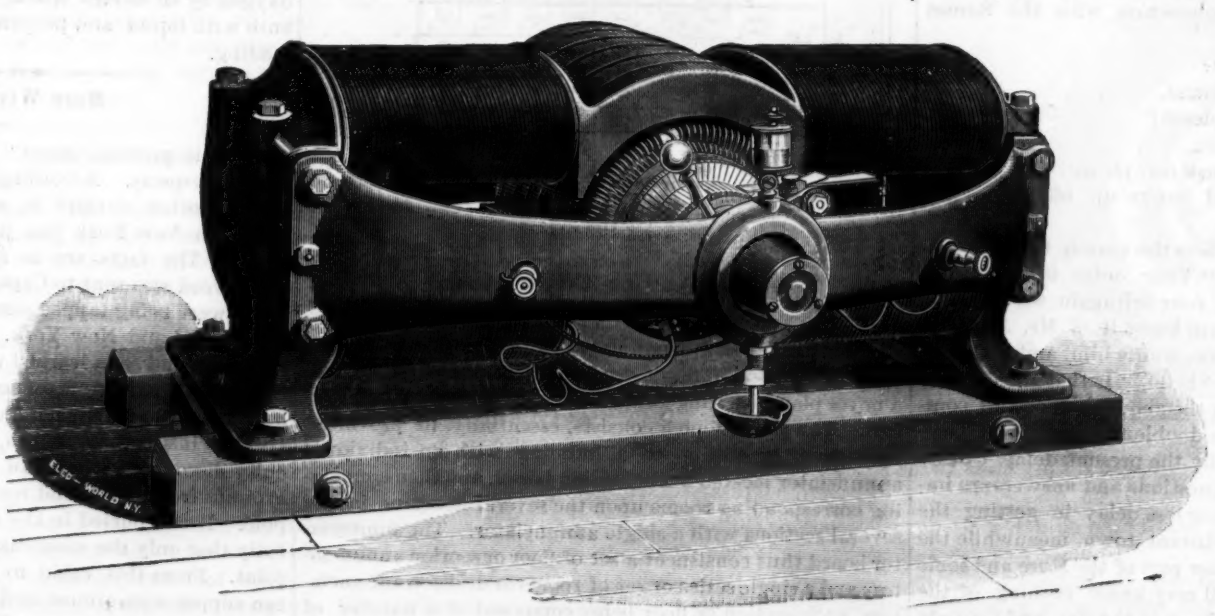


FIG. 2.—NEW DYNAMO OF THE JENNEY ELECTRIC COMPANY OF INDIANAPOLIS.

With regard to the question of safety, he and other speakers stated that after considerable experience with high potential dynamo work, they had seen no serious accidents. One gentleman (Mr. Wright), however, mentioned that he had once received a shock from an 1,800-volt machine which he had no desire to repeat, although he felt nothing at the time. Mr. J. W. Swan praised Mr. Bernstein's efforts, and recommended that the switches should be neat as well as effective, and pointed out that the expense of lamps and fittings was an important consideration.

Mr. Swinburne referred to an installation of glow lamps in series, which to some extent anticipates Mr. Bernstein's system; and Mr. Wharton, of Messrs. Laing, Wharton & Co., of Holborn Viaduct, who had fitted up a Thomson-Houston dynamo and lighted a series of eight Bernstein lamps during the evening, showed how the machine in question served to drive the system, with arc lamps also fed from it. The dynamo was the self-regulating automatic machine now used in the United States for arc lighting.

A New Electric Light Tower and Improved Dynamo.

City lighting by means of arc lamps placed upon towers seems to be gaining favor very rapidly, especially in our Western cities. The placing of a number of powerful lamps in elevated positions has the advantage of distributing the light more evenly over a larger area than would be possible with a similar number of lamps near the surface. Taking into consideration, also, the fact that the cavity formed in the upper positive carbon causes a large portion of the light to be projected downward in the form of a cone, it is apparent that with lamps near the surface the immediate vicinity of the lamp-post receives the most intense light, to the detriment of the illumination of outlying space.

The introduction and use of tower structures has been somewhat hindered by the materially increased first cost of plant consequent upon their use, and by the obstruction of the streets by the foundations and lower framework of some of the early forms of these towers.

Notwithstanding these hindrances, the tower system has grown rapidly in public favor, and there are now in use in this country nearly three hundred electric light towers, with a fair prospect that the number will be largely increased before the close of the present year.

Among the towers of recent design is the one illustrated in the accompanying engraving, devised by Mr. P. S. Adams, of the Jenney Electric Company, of Indianapolis, Ind. The height of this tower is 125 feet, and it is designed specially for strength and to prevent the obstruction of the streets. People are learning that the additional first cost of plant, with towers, is much more than compensated for by the superior quality of the light and by the increased area illuminated thereby.

The tower illustrated in the engraving is, as stated, 125 feet in height, and embodies numerous improvements designed to cheapen the processes of manufacture and erection, to give strength and beauty to the structure, and to leave the streets clear for traffic. The lamps are supported in iron frames mounted upon pivoted arms extending from the railing posts of the trimmer's platform. This arrangement greatly reduces the amount of wind surface at the top of the tower, and of shadow at its base, permits the use of any desired number of lamps, and adds materially to the appearance of the structure. The tower structure consists of a central vertical mast, in sixteen-foot sections, trussed by horizontal struts and vertical and diagonal brace rods or ties. It is supported by means of guys of galvanized wire rope, connected to suitable guy posts, firmly set at the curb line of the sidewalks, the whole forming a trussed structure of great strength and neatness.

The Jenney Electric Company, of Indianapolis, has also lately made several improvements and changes in the form of its dynamo, which we illustrate as it now appears. As will be seen, the arm which carries the armature consists of a rigid casting extending from end to end of the field magnets, and bolted to the latter at their neutral points. This construction permits of the use of long overlapping field magnets, without entailing the use of a needlessly long armature shaft.

Another feature in this construction is the fact that the greatest strength of the arm lies in the direction of the pull of the belt. Fitted in these arms are self-adjusting swivel-boxes or bearings for the armature shaft, provided with sight-feed, automatic oil cups, so arranged that each drop of oil fed to the bearings can be seen, thus enabling the operator to be sure whether the bearings are being lubricated or not.

The boxes themselves are babbitted and reamed out to an accurate size, are interchangeable, and can be removed from the machine and replaced without disturbing the armature or removing the arm.

Mr. Garland's regret that the Pan-Electric job had not "panned out better" was the saddest pun ever evolved from the fancy of an injured statesman. It will go down to posterity with the last efforts of the poet Rogers.—*Baltimore Herald.*

Telephone Exchanges Methods on the Pacific Coast.

Scarcely any part of the country has of late escaped agitation on the subject of telephone legislation whose aim is principally to enforce low subscription rates. It is but too true that the dishonest lawmaker will seek to make money out of any business enterprise that is liable to attack, and he has therefore not treated the telephone as an exception; yet it may also be true that the prevalent and general method of collecting telephonic revenues has been instrumental in fostering public discontent and in bringing about the existing unsatisfactory state of affairs. It is noticeable that California has been very free from troubles of this character, and it is not an unfair assumption that the system in vogue, as employed by the Pacific Bell Telephone Company, of payment by results, has much to do with the happier conditions that exist there. The subscriber who makes only slight use of his telephone always feels it unjust that he should pay as much as other subscribers who use theirs any number of times daily; and the higher the rates the greater does the disproportion of return become for the money paid. It may not be amiss, therefore, to give some idea of the manner in which the system adopted in San Francisco works.

The charge made by the exchange is $5 a month, and 5 cents a switch. Supposing that the subscriber used his telephone five times a day, at a total charge of 25 cents, the service would cost him about $135 a year. But at this point a remarkable fact is developed. Although the exchange has, in round numbers, 2,000 subscribers, the connections daily are only about 2,000 to 2,500, or barely more than 1 per subscriber on the average. Hence the subscriber has the telephone always at his service and gets his work done at the cost of about $75 a year, a small sum in view of the size of the city and the usual cost of such conveniences there. The little 5 cent charge serves to cut off all "dead head," unnecessary or trivial use of the telephone, and the extent to which such use may run is shown by the fact that according to careful statistics Detroit averages 10.6 calls per subscriber daily, while Kansas City, with 1,254 subscribers, claims a total of 21,820 connections daily, or 17 per subscriber! Another point is that the exchange can handle the smaller amount of work far more quickly, and has a strong inducement to develop business as much as possible; whereas, an exchange operated on the other basis is overcrowded with work it should not be called upon to do, and is under every temptation to keep business down so long as it gives satisfaction. The San Francisco exchange has 12 operators, and it is understood that the 5 cent revenue meets all operating expenses, leaving the fixed rental to meet the expenses of maintenance, royalty, etc., and to pay profit on the investment. The San Francisco exchange is about to put in a new multiple switch-board from the Western Electric Company, of ten sections of 200 each. The board will have a capacity of 2,500 wires, but at present will be fitted up for 2,000.

All the extra-territorial or toll-line business is turned over to the sub-organization known as the Sunset Telephone-Telegraph Company, which owns the lines connecting San Francisco with nearly 100 interior towns throughout the State of California. The manner of switching is illustrated by the following conversation. The subscriber calls up the exchange:

Operator: What is it, please?

Subscriber: Sunset room.

(Central office makes the connection with the Sunset room).

Operator: Here's the Sunset.

Subscriber: Give me 42 Oakland.

Operator: Who is talking, please?

Subscriber: Mr. Jones.

Operator: Whom shall we ask for, please?

Subscriber gives name and hangs up telephone till called.

In explaining to the subscribers the reason for this procedure the company says: "Your order is now fully understood, and when we ring your bell again, we will have Mr. Brown at Oakland; he will know it is Mr. Jones at telephone No. 46, San Francisco, wants him, and both will be saved a lot of preliminary 'hello,' 'Is that Mr. Jones?' 'Who are you?' etc., etc. By the above method the company's lines can accommodate double the amount of business and reduce very materially the present delay caused by 'line busy.' The last two questions and answers are important, because there is more or less delay in getting the particular party wanted in a distant town, meanwhile the party calling may go to another part of the store and some one else responding to our call may know nothing of the matter. This happens every hour in the day, and not only delays you, but keeps the line from others." It may be pertinent to remark that the company by making note, as it does, of the information thus given, is able at all times to meet any denial on the part of the subscriber that he used the line.

Another interesting little feature of the San Francisco system is what is known as the "telephone carriage switch." A livery company, in which Mr. Ladd, the president of the telephone company, has a large interest, agreed to pay the exchange 25 cents for each order for a carriage received over the telephone. Naturally enough, the other carriage companies were willing to do the same, and the telephone company derives quite a revenue from this source. The particulars of the call are entered on small pink blanks, and the amounts due are collected regularly.

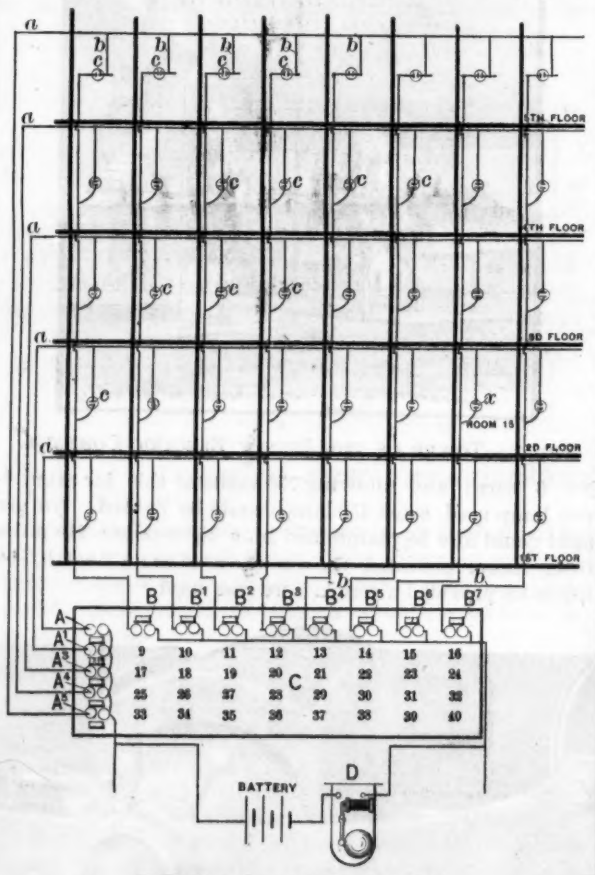
Going beyond San Francisco, we find Los Angeles with about 500 subscribers; Stockton with 300; San Diego with 75; Sacramento with 200, and Portland, Ore., with 400. At Los Angeles, where Mr. R. A. Brown is the energetic manager, the rates are $5 per month for 100 switches and $6 for an unlimited number of connections. Three operators do the work. As a matter of fact, they do not count every switch, but in a general way they soon get the average of a subscriber, and if after a while he is found to exceed his limit steadily, he is advised of it, when he can reduce his use of the service or pay more. The average work is 1,500 messages a day, and about 150 extra-territorial messages. In some towns the rate is $4 a month and 2 cents per switch, or $6 unlimited switching. The conclusion has been arrived at from observation, however, that the system does not work at its best with less than 300 subscribers. At many small places throughout California, therefore, the "flat-rate" method is in operation. It is only in the larger cities that the switch charge system is in vogue. At Los Angeles it answers well, and the first multiple switch-board on the Coast is there, being a 1,000-wire board, with a present capacity of 600.

Other points also show remarkable activity and development. Thus, in the County of San Diego there are now 236 miles of telephone wire, and the additions during 1885 alone aggregated 172 miles.

Enough has been said to show that under the able direction of Mr. Geo. S. Ladd, the President; Mr. J. I. Sabin, the Superintendent; Mr. Oliver Eldridge, the Vice-President, and Mr. W. G. Oliver, the Secretary and Treasurer, the Pacific Bell Company in working out its special system has met with notable success, and that golden lessons may be learned in the vicinity of the Golden Gate.

A New System of Electric Annunciators.

In large buildings and hotels, the expense of wiring and of the annunciator board is frequently very considerable, and it was with the idea of reducing both the cost and



NEW FORM OF ANNUNCIATOR.

simplifying the annunciator system that Mr. Paul Seiler, of San Francisco, Cal., devised and patented not long ago a novel plan of wiring and arrangement of the annunciators. The plan adopted consists, essentially, in providing each floor or section of a building with an individual annunciator located at the station-board, and then connecting corresponding rooms upon the several floors or in the several sections with a single annunciator. The annunciator board thus consists of a set of floor or section annunciators and a single series or set of rooms or division annunciators, each section or floor being composed of a number of rooms or divisions equal to those of any other section in the system. Hence instead of employing a separate wire and an individual annunciator for each room, only a single set or row of annunciators is needed, with each of which corresponding rooms throughout the entire number of floors or sections are connected by means of a single wire. The two signals are operated simultaneously, and thus the exact location of any room as to floor or section can be distinguished.

As shown in the diagram, the annunciator C is provided with a number of drop-indicators A A', etc., arranged in vertical series along one side or edge of the board, and suitably marked to correspond with the several floors, stories or sections of the building. Connection of the set of indicators with a battery is made by a battery-wire a, and from each indicator a continuation of the battery-wire is carried up to each floor or section corresponding to the mark or number of that indicator, and thence along the floor or section from end to end, to intersect each room or division thereof. Upon the same board, but disposed horizontally, is a set of similar indicators B B', etc., corresponding in number to the rooms or divisions on the floor, and numbered accordingly, beginning with No. 1 and ending with the highest number contained on the floor. The number of rooms being equal on all the floors, a wire is led from the first of the horizontal indicators up through all the rooms that constitute the first on each floor, and in like manner a second wire is carried from indicator No. 2 of the set upward through room No. 2 of each floor, a single wire and indicator being in this manner arranged to operate for all rooms in corresponding line or position throughout the several floors. Each room is provided with the usual push-button c to connect the battery-wire with the room-wire, and connection of the horizontal set of indicators is made with the battery through a call-bell D. By this construction it will be seen that the effect of pressing the button in any room is to operate among the vertical set of indicators the particular one appropriated to that section, and in the horizontal set of indicators the particular one connected with that room or division whence the signal proceeded. Thus, when the call-button in any room—as, for instance, x—on the second floor in the diagram is pressed, the annunciator drop A^1 of that floor is operated, and at the same time the drop in the row B^6 corresponding to the number of that room in the series. Therefore, the number found at the intersection of the row A^1 with the drop B^6—15—is the room whence the signal proceeded.

From the description, it is evident the number of wires, drops and magnets, and the size of the annunciator, can be considerably reduced in comparison with the usual method of wiring and of individual drops for each room. It is understood that the system is likely to be introduced shortly.

Marcel Deprez's New Coulomb Meter.

In a note presented to the French Academy of Science, M. Deprez describes his new coulomb meter, consisting of a U-shaped glass tube, the ends of which are formed into one closed by large glass bulbs. Into one of the branches are soldered platinum wires forming electrodes, and a second pair of platinum wires are soldered into the corresponding bulb. This bulb, the whole of the branch and a small portion of the other branch are filled with acidulated water, whilst the other bulb and the remaining portion of the branch contain air. If a current be sent through the electrodes, gas is evolved which accumulates in the bulb, depressing the level of the liquid there and raising it in the other branch. A suitable scale attached to this branch serves to indicate the total quantity of electricity which has passed in a given time. It is worthy of notice that neither the barometric condition of the atmosphere nor its hygrometric condition have any influence on the accuracy of the reading, the apparatus being hermetically sealed. The only precaution necessary to be observed is to keep the two branches of the U tube at the same temperature. The second pair of wires in the glass bulb serves to explode the mixture of hydrogen and oxygen by an electric spark, when it is desired to refill the bulb with liquid and prepare the instrument for another reading.

More Wire Tapping.

There is probably more "wire tapping" done than the public suspects. According to the Passaic City, N. J., *News*, another attempt to make money out of the pool-sellers in New York has just been discovered and frustrated. The facts are as follows: About the middle of April word was sent to Captain Hendry that the telegraph wires were being tapped somewhere between the Clifton raceground and New York. He at once set out to investigate, and soon learned that the old drum-corps room in North Passaic, now owned by Borneman Brothers, had been rented to three men from New York for $20 a month. He then instituted a search, and after considerable difficulty discovered where an insulated cable leading under ground from the band room connected with a telegraph pole. It was buried in the wood and puttied over so carefully that only the most careful scrutiny could detect the joint. From this cable to the telegraph wire overhead ran copper wire almost as fine as a hair, which was invisible a few feet away. "These disclosures were all that the Captain needed to convince him that he had found the place where the tapping was done, and his next purpose was to capture the tappers. The next afternoon he hid in the brush near by, and when the 2:26 train arrived he was rewarded by seeing three men alight at Harrison street and enter the shanty. He still kept in ambush, hoping to get sufficient evidence on which to convict. The men remained inside only a few minutes, when one of them came out and glanced cautiously around. Shortly afterward they left and took the next train for New York. The Captain allowed them to go, feeling sure that they would return. He then went

to the depot and sent a message to W. J. Holmes, Superintendent of the Western Union Company, advising him of what he had seen, and also of his purpose of capturing the tappers next time they came. The superintendent promised to meet him, and arranged with him for the future, but instead of keeping his word he sent a lineman, who, without consulting anybody, went and tore up the connection which the tappers had made and carried off their wire and tools. This, of course, ends all possibility of catching them, as they must have learned that their rendezvous has been broken up. Their purpose was to send bogus telegrams to the poolsellers to pay whatever pools the tappers and their friends were interested in."

The Wenstrom Dynamos.

Among the novel forms of dynamo recently devised, those of M. Wenstrom, a Swedish inventor, are of interest, as the designer has sought, in his own peculiar way, to prevent the magnetic field from spreading uselessly in directions outside of the dynamo. To accomplish this he covers the entire machine with a magnetic shield of iron, one form of his dynamo being represented in the engraving Fig. 1. In this type of machine the shield takes the form of a cylinder, and constitutes part of the frame, presenting a very curious appearance. The axis of the field magnets is vertical, and the pole-pieces are deeply cored from above and below respectively. Figs. 2 and 3 are views of another type of machine, which is of the multipolar type, having three positive and three negative poles. As will be seen, the axis of the field magnets corresponds to that of the armature. The pole-pieces consist of an interior core constituting the north poles, and of two external connecting pieces forming the south poles. The core and the connecting pieces are joined to one another by the envelope *C*.

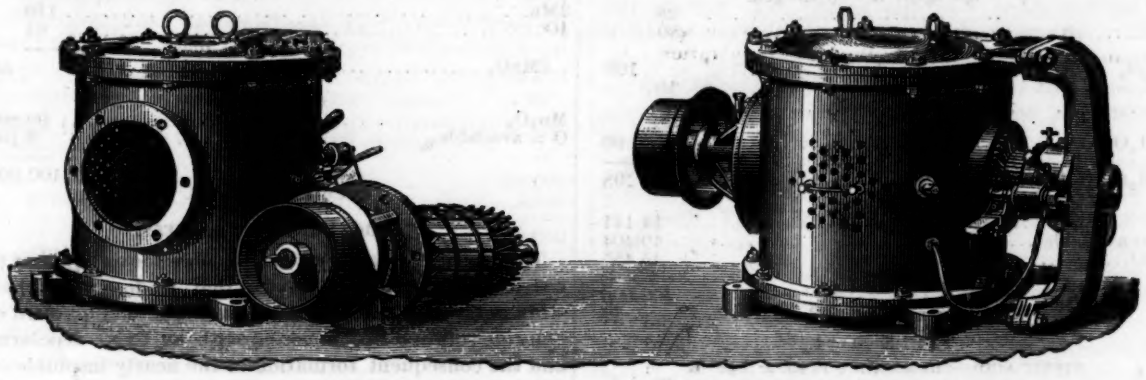


FIG. 1.—THE WENSTROM DYNAMO.

The machine has three pairs of brushes, and the three circuits of the armature are connected in multiple.

One feature of the armature worthy of notice is the manner in which the wires are disposed. As will be seen, they are not merely laid upon the surface of the cylindrical iron core, but are incased in circular grooves made in the mass of iron. This results in a more regular surface of the coils and diminishes the space between the wire and the pole-pieces. According to the inventor, the mass of iron between two consecutive generating coils performs the additional function of concentrating the magnetic field upon the interior of the machine, and in proof of this M. Wenstrom cites the fact that when the machine is in operation no trace of magnetism is perceptible on the exterior of the machine. When the coils are raised, as in the usual form, the envelope or sheath shows a considerable magnetic force.—*La Lum. Elect.*

The Indianapolis Jenney Light at Madison, Ind.

The local papers of Madison, Ind., are fairly bubbling over with joy at the starting up there of the new electric light system installed by the Jenney Electric Company, of Indianapolis. Thus the *Evening Herald*, of April 23, says:

"The electric light is pronounced a success by every one except some of the stockholders in the Gas Company. They think the light is well enough, but they pity the taxpayers on account of the cost. The cost of gas for the past year was $7.652.45. The cost of the electric light with the present number of lamps will be $3,501.75. As the latter costs $4,150.70 less per annum than the former, the people are unable to sympathize with the Gas Company in its lamentations and weeping for the taxpayers in this instance. There is no doubt, however, but that ten or more lamps will have to be added to distribute the light equally. This will necessitate the purchase of another 30-light dynamo. The cost of the dynamo, the necessary wire and the additional lamps would not exceed $3,000, making the cost of the plant about $15,000. The cost of lighting the ten lights would be, according to the contract, 15 cents each per night, or $1.50 for all, or $547.50 for the year. Added to the cost of running the plant as it now stands we have $4,049.25, or $3,603.20 less than it cost for gas with a light as far superior to gas as the brightest noon-day sun is to the rays of a quarter-moon. The electric plant is certainly a good investment. It is a long step forward in the marching line of civilization and economy."

The same paper contains a number of highly laudatory paragraphs on the light. The Madison *Courier* says: "The announcement yesterday that last night electricity would, for the first time in the history of the city, dispel the darkness of her streets, attracted hundreds of citizens to the main thoroughfares, along which the lamps are distributed in reasonable abundance. Many visited the station to observe the preliminary arrangements, while others sought available points from which to gaze upon the light in all its glory, if glory was one of its properties. A perfect throng of people moved incessantly up and down the streets, among them even residents of other towns, who gave evidence of being remarkably interested. The operators at the station before turning on the current awaited the arrival of Messrs. Rorison and Hollowell, who came in on the evening train. At 8:30 o'clock the engine was started, and such a flood of mellow light as emanated from the lamps over the city has never before been witnessed here. It was almost as light as day, and far up and down the street the steady glow of the lights could be seen imparting to the surroundings a truly city air. The small boy was wild with

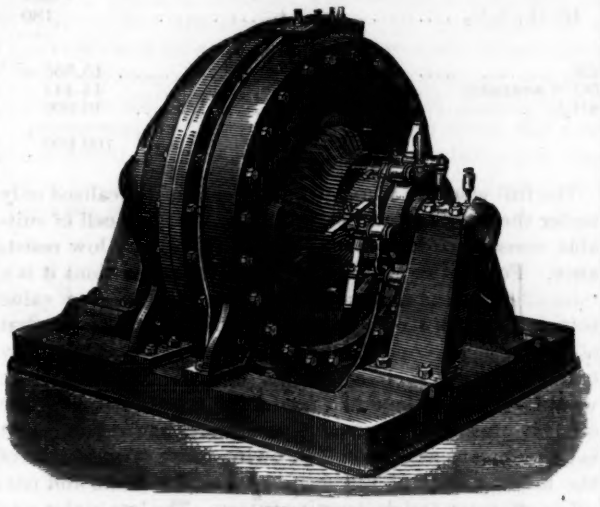


FIG. 3.—THE WENSTROM DYNAMO.

enthusiasm, and was ably seconded in his demonstrations by children of an older growth. In the full glare of the Main street lamps even the most pronounced skeptics bowed their heads in silence and admitted to themselves, if not audibly, the beauty, the power and effectiveness of this—man's latest triumph."

The Madisonians evidently know a good thing when they see it.

Electric Submarine Vessel.

An electrical submarine vessel has recently been tried at Liverpool with complete success, we are told. The vessel, which is cylindrical in shape, is about 37 feet long over all, 6 feet diameter amidships, tapering to a point at each end. A conning tower is placed on the top, in the sides of which are ports which enable the steersman to see in every direction, and which is covered by a strong, water-tight scuttle for access to the interior of the boat. The depth of the vessel below the surface of the water is regulated by two inclined planes, one on each side, worked by a lever amidships; and in addition there is a rudder aft, worked by a self-acting arrangement for keeping the vessel always in a horizontal position. The interior fittings are so arranged that the boat may be worked by one man, but the usual crew would be two men. At each end of the boat is a compartment for the storage of compressed air, which can be used when the boat is kept below water for a lengthened period. At the same time, owing to the absence of boiler, fire, etc., there is sufficient air space for two men to remain below water for six hours without drawing on the storage. The motive power, electricity, is stored in fifty large accumulator cells, which, when charged, are capable of driving the boat at the speed of about nine miles an hour for ten hours, either at or beneath the surface of the water, or at slow speed will drive her for about 250 miles without recharging. The motor drives the screw direct at about 800 revolutions per minute. This motor can also be coupled direct to a centrifugal pump, which, in a few minutes, empties the water ballast tanks which are used to submerge the vessel. The interior is lighted by incandescent lamps, in addition to which there is a powerful electric search lamp on the conning tower, which enables the steersman to see below water as well as above. This is, it is said, the most powerful installation of electrical power ever fitted to any boat, and has been carried out by Messrs. Perry and Cox, of Liverpool, the storage cells being supplied by the Electrical Power Storage Company, London. One of the chief advantages claimed by the inventor is that a boat of this description can be carried on the davits of any man-of-war, and the cells charged from the dynamos while hanging on the davits. She is thus ready for use at once. A trial of this interesting vessel was made in Liverpool in the presence of inspectors from the Admiralty, who expressed themselves highly satisfied with the results.

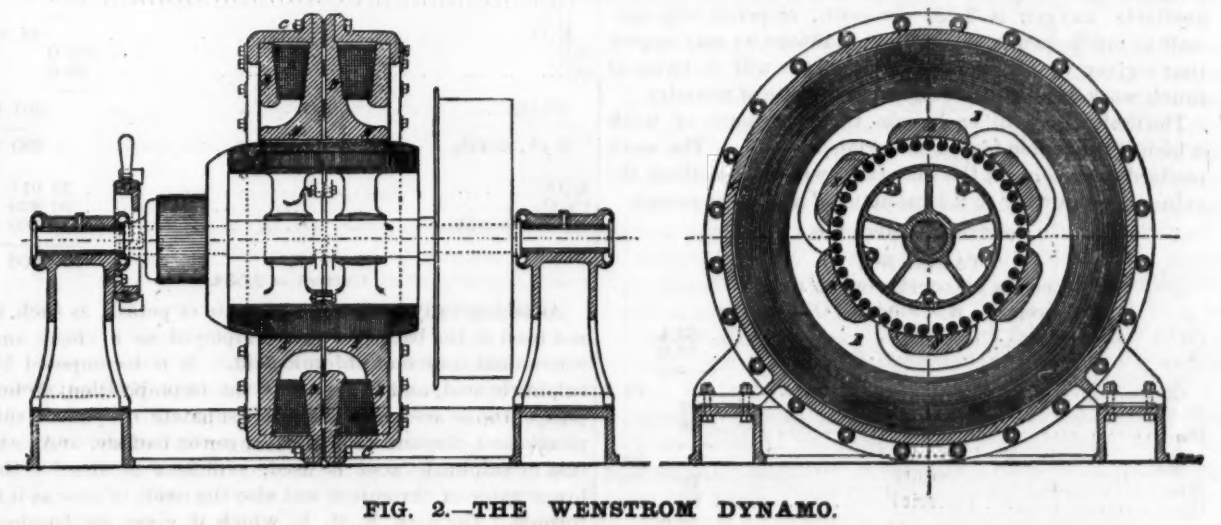


FIG. 2.—THE WENSTROM DYNAMO.

Pen Sketches of Telephone Magnates.

The recent hearings of the Pan-Electric Investigation Committee in Washington appear to have aroused considerable interest in some of the witnesses, especially those who hold the millions of Bell stock after which the Pan-Electric people go hungering and thirsting. Mr. T. C. Crawford, one of the Washington correspondents, feels called upon to describe Prof. Bell, Mr. Hubbard and Mr. Forbes. His sketches of the last two may be quoted:

Gardiner G. Hubbard, the father-in-law of Mr. Bell, appears to have been the original capitalist in the enterprise. He is a tall, slight man, who is inclined to be round-shouldered. He dresses in plain black and wears a long coat of the style affected by some of the orthodox clergy. He has a shrewd, angular featured face, which is nearly concealed by an enormous gray mustache and long patriarchal beard which descends far downupon his breast. His keen gray eyes are deep set behind a pair of steel-rimmed spectacles which he always wears. He is a great student, and is engaged in a number of business enterprises. He is quite a collector of pictures. He has an original Corot, one that Corot pronounced as belonging to the best five of his pictures. He has a number of other pictures which he has picked up in his wanderings in Europe. Mr. Hubbard occupies one of the handsomest houses in Washington next to the Dupont Circle, facing on Connecticut avenue.

The President of the Bell Telephone Company, Mr. Forbes, is a very plain, dry, correct-mannered New England business man. He is a tall, square-shouldered, muscular, athletic-looking man. Every line of his dress shows the correct, methodical habits of the man. There has been no more precise witness before the committee. He has a resolute, determined-looking face. He is a dark blonde. His hair is cropped close behind and parted exactly in the middle over a broad, full forehead. His eyes are a clear blue. His nose is straight. A light blonde mustache shades his mouth. His square, well-defined chin is smooth-shaven. He is the son of the Forbes who is such a large holder of the property of the Chicago, Burlington & Quincy road. His father is worth at least $10,000,000. This square, hard-headed looking young man

cannot now be over forty years of age. A more self-contained, self-poised individual has never appeared before a Congressional committee. Everything with him was a matter of business. He answered every question put to him, but did not volunteer a single word.

Electric Power for St. Louis.

An earnest effort is to be made by the Electric Railway and Power Company of St. Louis to furnish small electric powers to the inhabitants of that city. The company has a capital stock of $350,000; Dr. Wellington Adams is the General Manager, and Prof. Francis E. Nipher is the consulting electrical engineer. The main plan is the operation of an electric railway, but the general distribution of power also is proposed. The schedule of rates is as follows:

Rate.	Size of motor.	Charges per horse-power.
	Horse-power.	Per hour.
"A."	¼ to 1	16 cents.
"B."	1 " 3	10 "
"C."	3 " 5	7 "
"D."	5 " 10	5 "
"E."	10 " 15	4 "

These rates are based on the assumption that the power will be used from 6 to 10 hours each working day. A higher rate will be charged where the power is used for a shorter period each day.

The company offers to make the installation free of cost to the consumer, and to keep the motor in order, charging a monthly rental for the power and the motor.

The Relative Working Values of Battery Materials.

BY D. H. FITCH.

(*Copyrighted*, 1886.)

The following tables, giving the relative working values of the various materials which have been used to excite galvanic batteries, are based upon the theory of electrolysis and the conservation of energy.

The potential of a battery is due to the "energy of position" of oxygen or chlorine, respectively, which forms a part of the materials used as excitants or depolarizers. Under favorable conditions the oxygen or chlorine has a tendency to leave the compounds in which it is combined, and to unite with the zinc—a chemical attraction or force. When the conditions are favorable, as they are in the battery with the circuit closed, and this change having taken place the attraction is satisfied, it ceases to exist as such, and in its stead we have that form of energy which we call electricity. The cell may be called a device for converting chemical attraction into electrical energy.

The sum of current or work done is in proportion to the amount of this chemical change in the various materials respectively, and the E. M. F. is in proportion to the strength of the chemical attraction or rather the ease with which the materials are decomposed and give up their oxygen or chlorine. Those which decompose most easily give generally the highest E. M. F.

In the tables, the values given after the word "current" are not intended to represent the strength of the cell or the volume of current flowing in a given time, but the sum of the current or work which the materials can yield without reference to time. For example, in a unit weight of "blue vitriol," the available oxygen is 6.415 per cent. of the total weight. In an equal weight of sulphate of mercury, the available oxygen is 3.226 per cent., or practically one-half as much; hence, under like conditions we may expect that a given weight of sulphate of copper will do twice as much work as an equal weight of sulphate of mercury.

The tables give in each case the maximum of work which it is possible for the materials to yield. The work realized from some of the materials will be less than the values given, owing to "local action" and other causes.

OXYGEN COMPOUNDS.

TABLE NO. 1.

SULPHATE OF COPPER (BLUE VITRIOL).

Cu = copper; S = sulphur; O = oxygen.

Cu	63.4	
O	16.0	
CuO		79.4
S	32	
O_3	48	
SO_3		80.0
H_{10}	10	
O_5	80	
$5H_2O$		90.0
$CuSO_4 + 5H_2O$		249.4

Percentage.

Cu	25.421+
O = available	6.415+*
SO_3	32.077—
$5H_2O$	36.087—
	100.000

Current *unit*, one.

* Oxygen unit = 6.415.

Sulphate of copper, so long and extensively used, is taken as a standard, and the sum of work which it can yield as a unit for comparison with other materials, and the percentage of available oxygen which it contains, viz., 6.415, is taken as the oxygen unit in these tables. In cells of suitable construction and with closed circuit of low resistance, nearly the maximum of its energy can be realized. If the circuit is open or the external resistance is large, it diffuses through the solution, comes in contact with the zinc, and causes "local action" and more or less loss.

TABLE NO. 2.

BI-MERCURIC SULPHATE (SULPHATE OF MERCURY).

Hg = mercury.

2Hg	400	
O	16	
Hg_2O		416
S	32	
3O	48	
SO_3		80
$Hg_2S\ O_4$		496

Percentage.

2Hg	80.645+
O = available	3.226—
SO_3	16.129+
	100.000

Current = 0.503.

TABLE NO. 3.

NITRIC ACID — COMMERCIAL = 140° B.

N = nitrogen; H = hydrogen.

2N	28	
5O	80	
N_2O_5		108
10H	10	
5O	80	
$5H_2O$		90
$5H_2O\ ,\ N_2O_5$		198

Percentage.

2N	14.141+
5O = available	40.404+
$5H_2O$	45.455—
	100.000

Current = 6.298.

TABLE NO. 4.

NITRIC ACID—CHEMICALLY PURE = 142° B.

2N	28	
5O	80	
N_2O_5		108
8H	8	
4O	64	
$4H_2O$		72
$4H_2O\ ,\ N_2O_5$		180

Percentage.

2N	15.556—
5O = available	44.444+
$4H_2O$	40.000—
	100.000

Current = 6.928.

The full working value of nitric acid can be realized only under the most favorable conditions, viz., in a cell of suitable construction, and closed circuit of very low resistance. For service which admits of these conditions it is a most efficient and economical excitant; its working value being more than six and a quarter times as great as that of sulphate of copper. Lighting incandescent lamps by battery suggests such a service, and the Grove battery would no doubt be much used for this were it not for the offensive fumes. On circuits of considerable resistance it is by no means as economical, owing to the liberation of the lower oxides of nitrogen, which are volatile and pass off in offensive and destructive fumes. The loss in this way may reach as high as 80 per cent.

TABLE NO. 5.

BICHROMATE OF POTASH.

K = potassium; Cr = chromium.

2K	78.2	
O	16.0	
K_2O		94.2
2Cr	105.0	
6O	96.0	
$2CrO_3$		201.0
$K_2O\ ,\ 2CrO_3$		295.2

Percentage.

K_2O	31.911—
Cr_2O_3	51.829—
3O = available	16.260+
	100.000

Current = 2.584.

As is generally known, bichromate of potash, as such, is not used in the battery. It is employed as a cheap and convenient source of chromic acid. It is decomposed by sulphuric acid, and the result of the decomposition, an impure chromic acid, consisting of sulphate of potash, sulphuric and chromic acids, is used in the battery. An excess of sulphuric acid is used, sufficient to dissolve the lower oxide of chromium and also the oxide of zinc as it is formed. The high E. M. F. which it gives, its freedom from destructive fumes, and the fact that in ordinary practice it yields nearly its full working value, make it a very desirable material for closed circuit service.

TABLE NO. 6.

BICHROMATE OF SODA.

Na = sodium.

Na_2	46	
O	16	
Na_2O		62
2Cr	105	
6O	96	
$2CrO_3$		201
$Na_2O\ ,\ 2CrO_3$		263

Percentage.

Na_2O	23.580—
Cr_2O_3	58.170+
3O = available	18.250—
	100.000

Current = 2.884.

The remarks above apply to bichromate of soda. Its working value is slightly more than that of bichromate of potash.

TABLE NO. 7.

CHROMIC ACID.

2Cr	105	
6O	96	
$2CrO_3$		201

Percentage.

Cr_2O_3	76.119+
3O = available	23.881—
	100.000

Current = 3.722.

Sulphuric acid should be used in connection with chromic acid for reasons given under the head of bichromate of potash.

TABLE NO. 8.

BINOXIDE OF MANGANESE (PEROXIDE OF MANGANESE).

Mn = manganese.

2Mn	110	
4O	64	
$2MnO_2$		174

Percentage.

Mn_2O_3	90.805—
O = available	9.195+
	100.000

Current = 1.433.

PEROXIDE OF MANGANESE.

The Leclanché battery was so superior to any that preceded it for open circuit service, that it deservedly had a wide reputation and extensive use. The employment of a chloride solution in connection with an oxide depolarizer, and the consequent formation of the nearly insoluble oxychloride of zinc, with its tendency to fill the pores of the cups and plates, may be a disadvantageous feature.

TABLE NO. 9.

PERMANGANATE OF POTASH.

2K	78.2	
O	16.0	
K_2O		94.2
2Mn	110.0	
7O	112.0	
Mn_2O_7		222.0
$K_2Mn_2O_8$		316.2

Percentage.

K_2O	29.792—
2MnO	44.908—
5O = available	25.300+
	100.000

Current = 3.944.

TABLE NO. 10.

PERMANGANATE OF SODA.

2Na	46	
O	16	
Na_2O		62
2Mn	110	
7O	112	
Mn_2O_7		222
$Na_2O,\ Mn_2O_7$		284

Percentage.

Na_2O	21.831+
2MnO	50.000—
5O = available	28.169—
	100.000

Current = 4.391.

The working values of the permanganates of potash and soda vary under different conditions, as shown in the following table:

	Work value.	Work value.	Work value.
Permanganate of potash	2.366+	3.155+	3.944+
" " soda	2.634+	3.512+	4.391+

TABLE NO. 11.

PERMANGANIC ACID.

2Mn	110	
7O	112	
Mn_2O_7		222
2H	2	
O	16	
H_2O		18
$H_2O\ ,\ Mn_2O_7$		240

Percentage.

2MnO	59.166
5O = available	33.333
H_2O	7.501
	100.000

Current = 5.196.

TABLE NO. 12.

CHLORIC ACID.

Cl = chlorine.

2Cl	71	
5O	80	
Cl_2O_5		151
10H	10	
5O	80	
$5H_2O$		90
$5H_2O\ ,\ Cl_2O_5$		241

Percentage.

2Cl	29.461—
5O = available	33.195—
$5H_2O$	37.344+
	100.000

Current = 5.174.

TABLE NO. 13.

PERCHLORIC ACID.

2Cl	71	
7O	112	
Cl_2O_7		183
2H	2	
O	16	
H_2O		18
H_2O , Cl_2O_7		201

Percentage.

2Cl	35.324—
7O = available	55.721+
H_2O	8.955+
	100.000

Current = 8.686.

Permanganic, chloric and perchloric acids are not likely to be much used in practice. The two latter when in use evolve large quantities of chlorine. Perchloric acid is interesting, as it probably has the highest working value of any material known.

TABLE NO. 14.

MERCURIC OXIDE.

Hg	200	
O	16	
HgO		216

Percentage.

Hg	92.600—
O = available	7.400+
	100.000

Current = 1.153.

Mercuric oxide, in connection with sal-ammoniac, is objectionable for reasons given under the head of peroxide of manganese.

TABLE No. 15.

PEROXIDE OF LEAD.

Pb = lead.

Pb	207	
2O	32	
PbO_2		239

Percentage.

PbO	93.300
O = available	6.700
	100.000

Current = 1.044.

Peroxide of lead batteries have been offered, but the table shows, probably, why they did not succeed. They have a low working value, and more than 93 per cent. of solid inert residue.

CHLORINE COMPOUNDS.

The combining weights of oxygen and chlorine are in the ratio of 16 to 35.5; hence, in chemical action, 35.5 parts of chlorine are required to give the same amount of current or work as 16 parts of oxygen.

The oxygen unit adopted for these tables is 6.415. Now,

16 : 6.415 : : 35.5 : 14.233 = chlorine unit.

TABLE NO. 16.

AMMONIUM CHLORIDE.

Sal-ammoniac

N	14.0	
H_3	3.0	
H_3N		17.0
H		1.0
Cl		*35.5
H_4N , Cl		53.5

Percentage.

H_3N	31.776 —
H	1.869 +
Cl = available	66.355 +*
	100.000

Current = 4.662.

* Chlorine unit = 14.233+.

Little need be said in regard to this material; it is well known. Under all conditions of practical service it gives nearly its full working value.

TABLE NO. 17.

MERCURIC CHLORIDE (CORROSIVE SUBLIMATE).

Hg	200	
Cl_2	71	
$HgCl_2$		271

Percentage.

Hg	73.800 +
2Cl = available	26.200 —
	100.000

Current = 1.840.

TABLE NO. 18.

MERCUROUS CHLORIDE (CALOMEL).

Hg	200.0	
Cl	35.5	
HgCl		235.5

Percentage.

Hg	84.920 +
Cl = available	15.080 —
	100.000

Current = 1.059.

The chlorides of mercury with sal-ammoniac, as used in the "chlorine" battery, present some novel features. Chlorine and mercury form two distinct compounds, one of which, mercuric chloride, $HgCl_2$, is easily soluble, hence adapted to closed circuit service; the other, mercurous chloride, HgCl, is insoluble, and hence well adapted as a depolarizer in open circuit batteries. In form, the cell resembles the "Disque" Leclanché, but instead of using peroxide of manganese, the porous cup is filled with a mixture of crushed carbon and the *insoluble* chloride of mercury. In this there is more harmony than in the manganese battery, because both a chloride solution and chloride depolarizer are employed, hence there is little or no tendency to the formation of oxy-chloride of zinc, and no filling or clogging of the pores of the cups or plates. When the mercurous chloride is exhausted by use, the residue is *pure metallic mercury.* It is liquid, a good conductor, and a good negative, and *occupies very little space.* The porous cup is not full; there is room for more.

Now if we introduce into the interior of the porous cup a solution of mercuric chloride = $HgCl_2$, it will attack the metallic mercury and convert it into mercurous chloride = HgCl, and be itself at the same time converted into mercurous chloride by loss of chlorine, as expressed in the following equation:

$$HgCl_2 + Hg = 2HgCl \text{ or } Hg_2Cl_2.$$

Notwithstanding that we use a soluble excitant, we have an insoluble depolarizer which is so essential for open-circuit service. The porous cup now contains what it did when originally made, and a greater quantity. Thus it can be cheaply and easily replenished to compensate for the most severe service. These materials also present the novel feature of a *useful local action*, and no destructive one, while the circuit is open.

The American Electrical Society, at its meeting in Chicago, in December, 1879, appointed a committee, of which Prof. H. S. Carhart, of the Northwestern University, was chairman, to test and report upon this battery. In his report upon its chemical action, read before the society at its next annual meeting, after describing its primary action by which a portion of the excitant is decomposed, and metallic mercury deposited on the carbon, he described its subsequent recuperative or regenerative action as follows:

"Metallic mercury is thus set free in a finely divided state on the carbon surface or in contact with carbon."

"I find by repeated experiments that mercury in a solution of sal-ammoniac, and in contact with carbon, constitutes a galvanic element, and corrosive sublimate and even calomel are slowly formed at the expense of the mercury and sal-ammoniac. Hence, in the Fitch battery a replenishing or recuperative action goes on when the circuit is open, tending to supply a fresh quantity of the depolarizing agent which is decomposed when the external circuit is closed. I know of no other battery in which a local circuit within the cell itself is turned to a useful account instead of exhausting the battery."

TABLE NO. 19.

CHLORIDE OF SILVER.

Ag = silver.

Ag	108.0	
Cl	35.5	
AgCl		143.5

Percentage.

Ag	75.261
Cl = available	24.739
	100.000

Current = 1.738.

TABLE NO. 20.

CHLORATE OF POTASH.

2K	78.2	
O	16.0	
K_2O		94.2
2Cl	71	
5O	80	
Cl_2O_5		151.0
K_2O , Cl_2O_5		245.2

Percentage.

2KCl	60.848
6O = available	39.152
	100.000

Current = 6.103.

Chlorate of potash, though a rich material, gives an E. M F. much too low for most practical purposes. It makes a very constant cell, absolutely free from waste action or loss, and of extraordinary cleanliness and durability. It may be used on electric clocks.

These tables are calculated for a *single* cell in circuit. When more than one is used in the same circuit the values are changed by difference in E. M. F. To ascertain the corrected value when more than one is used, multiply the value of current of the material which gives the highest E. M. F. by the relative E. M. F. of the same. For example, the relative E. M. F. of the sulphate of copper and nitric acid batteries as given by Clark is in the ratio of 56 to 100, or 1 to 1.7857, and the value of current for commercial nitric acid is 6.298 +. The corrected value of current for nitric acid when more than one cell is in circuit would be $6.298 \times 1.7857 = 11.246$. This is due to the fact that when several cells are connected, and a *given volume* of current is flowing, the same amount of chemical action takes place in each of the several cells. Fifty or one hundred cells will consume fifty or one hundred times as much as one cell. If the relative E. M. F. is in the ratio of 56 to 100, then 56 nitric acid cells will give the same E. M. F. as 100 sulphate of copper cells. In doing this the nitric acid cells will consume only 56 times as much as one, while the sulphate of copper cells will consume 100 times as much as one. Now if we multiply the corrected value of nitric acid by 56 we have $56 \times 11.246 = 629.77$; and the value of sulphate of copper by 100, we have $100 \times 1 = 100.00$.

The products give the same ratio as the values given in the tables. The economy of zinc in a chlorine action over that in an oxygen action seems to have been overlooked, at least in any text books which I have seen. It is given as a law that "when the same current passes through a series of electrolytes the weights of the separated *anions* are to each other as their chemical equivalents." The *anions* may be simple, as oxygen = 16, or chlorine = 35.5; or they may be complex, as $SO_4 = 96$. For illustration we will take the simple ones. A given quantity of current will liberate or transfer one equivalent of oxygen = 16, or one of chlorine = 35.5. Zinc unites with oxygen in one proportion only, viz., one equivalent of zinc to one of oxygen = ZnO; it unites with chlorine also in one proportion only, viz., one equivalent of zinc to *two* of chlorine = $ZnCl_2$. Now, as the volume of current is in proportion to the *anion*, or oxygen and chlorine respectively, and as one part of zinc saturates one of oxygen, while one part of zinc saturates two parts of chlorine, it follows that with a given current zinc is consumed twice as rapidly in an oxygen action as in a chlorine action.

It may be well to state that several of the materials named in the tables are patented.

Investigating the Pan-Electric Scandal.

The labors of the Pan-Electric Investigation Committee were resumed on April 27, when President Forbes, of the American Bell Te lephone, was examined as a witness. He said he had been president of the American Bell Company ever since its organization in 1880. He told of the growth of the company and the consolidation of the original New England and Bell co mpanies. Witness did not know that any officer of the government or members of Congress had been connected with the original companies or held stock at the present time in the American Bell Company. The witness estimated the total stock of the local companies licensed by the Bell Company at $50,000,000, of which the parent company held about $22,000,000, par value, or between $16,000,000 and $17,000,000 market value. Secretary Manning, who held stock in the Troy company, was the only government officer he knew of who held the local stock. Last year the company paid a dividend of 16 per cent.—12 regular and 4 extra—but in the first four years of the life of the organization no dividends were paid. Most of the net earnings were divided, but the company was accumulating a small reserve fund. They were building a system of lines connecting the principal cities, and had sought to secure the right to increase their capital from $10,0 00,000 to $30,000,000. The only newspaper publications in which the company had been concerned were an industrial article, for which the company paid, published in the New York *Times*, and an article in a paper known as the *Commercial World*.

The article in the *Times* was a four-column article written last January. It was solicited from the Bell company by an agent of the *Times*. The amount paid for its publication was $1,2 00. This article, after giving the history of the Bell company, criticised severely the attempt on the part of the government to bring a suit to set aside the Bell patent. The article in the *Commercial World* was of no account. It was an unimportant one, also solicited from him by an agent. He paid $100 for it, but never used the article in any way. Some two thousand extra copies of the New York *Times*, however, they bought and circulated.

Mr. Forbes was asked if he had anything to do with the publication of the original history of the Pan-Electric Telephone Company in the New York *World*. He had used, he said, no influence, direct or indirect, nor had any officer of the company. If any officer of the company had been instrumental in procuring any publications in the newspapers he would have been discharged, for the company had agreed in a meeting of the Board of Directors upon a different policy. A statement similar to the one printed in the *World* had been offered to the Bell company for them to purchase. It had come to him in Boston in a letter from Mr. Gardiner G. Hubbard, father-in-law of Prof. Bell. He did not know who had offered it to Hubbard. Mr. Hubbard's letter did not state that the article was offered to them for purchase, but he had so inferred. They declined to accept it after a conference of the Executive Committee. It was returned to Mr. Hubbard, and he was notified that the company did not care for it, and was positively averse to any newspaper exposure.

The examination was then directed by Chairman Boyle toward the interview the witness had had with the President. Witness said that, understanding that the government proposed to bring suit against the Bell Company, he had thought proper to state to the President the facts as he understood them.

Q.—And you had that interview because of the fact that public officers were connected with the Pan-Electric Company? A.—Because the President was proposing to take an unusual course to bring suit against our company.

Continuing, he said that the Bell lawyers had expressed the opinion that there was no authority for such a suit. Then it had been proposed to bring the suit in a remote part of the country. Those facts he had undertaken to lay before the President.

Q.—Then the Bell Company, through a private interview with the President, sought to prevent the bringing of a Government suit? A.—No sir; I sought to let the Presi-

dent understand the facts as I understood them and our view.

Witness went on to say that he had presented to the President a statement of the question of jurisdiction. He had pointed out to him that the suit about to come up in the Supreme Court would be decided before the government suit could be heard. He had pointed out to the President that it was the manifest intention of the Pan-Electric associates to secure a delay, not to get the Bell patents tried, but to leave them untried, and he thought the government ought not to lend its name to a scheme of that sort. He showed that the pendency of a government suit would be used to affect the proceedings in other courts—that they would be asked to grant stays in injunction proceedings during a long and tedious litigation in the name of the government. He had quoted Messrs. Storrow and Dickerson, who were in New Orleans, in expressing their belief that "the same game was about to be tried before Judge Pardee there." "I explained the motive of that whole gang so that he might understand it, for I wanted him to know what the government's name was to be used for," exclaimed the witness.

Q.—You assumed that the suit would be brought?

A.—Yes; I asked him to see to it that no unnecessary delays were permitted on the part of the government. I thought that the attempt would be made to drag this thing along. If the government were going to perpetrate this injustice upon us, I asked him if anything could be done to make clear the object. I spoke of the United States courts, where the parties were claiming that large suits should be hung up, and I asked him if it was proper that the Administration should say that that was not the intention of the government. I asked to have the question of jurisdiction carefully considered also.

It has been frequently charged by some of the newspapers unfriendly to the inquiry that Mr. Ranney was interested in the Bell Telephone Company and was acting as their attorney. Mr. Forbes said that Mr. Ranney had never been employed by them at any time. The only public men they had ever employed were Senator Hoar and Congressman Patrick Collins. This was for proper legal service done in Massachusetts. The books of the Bell Company being examined, it was found that Mr. Ranney several years ago had twenty shares of the Bell stock, but merely as collateral for a loan. He is not a holder of any stock now. The stock list of the Bell Telephone Company was also handed to the committee by Treasurer Driver, of the Bell Company. It does not include any public officials.

On April 28 Professor Bell was the first witness called before the committee. Professor Bell, in answer to questions from Chairman Boyle, gave a brief history of the steps he took to obtain his telephone patent, and the subsequent steps taken which led to the use of the telephone. He obtained his patent for the telephone in March, 1876; but before obtaining the patent he had parted with his inventions to an association, and since that time he had nothing to do with them personally. He entered into an arrangement with Mr. Hubbard and Sanders by which they were to pay the expenses of experiments and patents for telephonic inventions, as well as the expenses of putting the invention into operation. Under this arrangement, which was a mere verbal one, each party was to have one-third interest. He was paid no direct consideration by these gentlemen for assigning them the two-thirds interest. The first steps were taken in the autumn of 1876 to put the invention into operation. Chairman Boyle asked Professor Bell what he had done with his one-third interest, to which he replied that he had, before leaving for Europe, in 1877, made a gift of it to his wife, Mr. Hubbard's daughter. When the original Bell Company was formed, his wife received her share of the stock, and after the consolidation and formation of the American Bell Company she had received a proportionate amount of stock, and was now one of the largest holders of the stock.

Chairman Boyle asked: "Then her $10,000,000 interest has grown from the one-third interest in this instrument from 1876 to 1880?" To this Professor Bell replied in the affirmative.

The professor said he felt some pride in being on the stock list of the company, and so had purchased one share. This was all the stock of the company that he held in his own name.

Professor Bell, when questioned about the management of the American Bell Telephone Company, said he felt ashamed to acknowledge it, but confessed that he knew very little about the business affairs of the company, and so he was not interrogated about them.

Mr. Gardiner G. Hubbard followed Professor Bell. The original agreement between himself, Mr. Sanders and Professor Bell, referred to by Professor Bell, he said, was not in writing. This agreement was made in 1874, and subsequently out of it grew a joint stock company. The original Bell company was formed in Massachusetts in 1876. Mr. Hubbard held 1,000 shares of the present American Bell Company.

Mr. Hubbard was then questioned about the correspondence that he sent to the President of the company, Mr. Forbes, referred to in that gentleman's testimony. This correspondence, he thought, was substantially the same as the article that afterward appeared in the New York *World*. He received the screed from Professor Bell, who told him he got it from Gen. Sypher, of Washington. Professor Bell, in handing it to him, remarked that here was a curious and interesting paper relating to the Pan-Electric Company, but did not suggest its publication. Prior to this the directors and officers of the Bell Company, in discussing a policy to be adopted by the company, decided not to publish anything in regard to the proposed government suit; but this was such a peculiar document that he thought it best to send it to officers of the company, and so sent it to President Forbes. Mr. Hubbard had no knowledge how it got to the *World*, and was surprised to see it turn up in that paper.

Professor Bell was recalled when Mr. Hubbard left the witness chair, and told the committee how and when and from whom he received this screed. It came to him from his neighbor and acquaintance, General Sypher, with the following note, dated Oct. 26, 1885:

DEAR SIR: I hand you herewith an authentic statement of facts compiled by my associate, Mr. E. N. Hill, which may interest you. The scheme to destroy your patents was tolerably well matured, and it remains to be seen whether this reform administration will lend itself to its consummation. Truly yours, J. HALE SYPHER.

He regarded this as a voluntary offering and evidence of friendship on the part of a comparative stranger. He had acknowledged receipt of the paper and thanked the sender, and then had two copies of the article made. One he retained, one he gave to Mr. Hubbard, and the original he sent to Mr. Storrow, counsel for the company. Professor Bell was also surprised to see the article printed in the New York *World*, and subsequently asked Mr. Storrow about it and how it came to be published, but that gentleman said he had made no use of it with the newspapers.

Mr. O'Connor, who was private secretary to Hon. S. S. Cox, of New York, while a member of the House, testified that Mr. Cox had been given some Pan-Electric stock by Dr. Rogers, but that it was returned to Dr. Rogers. He was sure that Mr. Cox never held any Pan-Electric stock.

The first witness examined on April 29 was Gen. J. Hale Sypher, ex-member of Congress from Louisiana, who detailed how he and Col. E. N. Hill had prepared certain statements in regard to Pan-Electric matters. Hill had been in the employ of Col Casey Young, but Sypher's first information on the subject came from Capt. Cahoon, of the National Improved Telephone Company. Capt. Cahoon told him there was a combination to smash the Bell patent.

Mr. Whitelaw Reid said in his evidence that the first dispatch received by the *Tribune* upon the subject of the Pan-Electric affair was sent to them by Major Clark, one of his correspondents at Washington. He had held it three or four days, and had telegraphed Major Clark asking him if he was sure of the facts. He had sent out his reporters and had interviewed the representatives of the Bell people in New York before he had made any publication. Mr. Reid had paid no money for the articles furnished to him except the salary to the correspondent at Washington. If there had been any sums paid, they were small and trifling. He emphatically denied that he had been paid any money by the Bell Telephone Company for the publication of the articles. He had no interest in any Bell Telephone stock. He held no interest in the Western Union stock. He said that Mr. D. O. Mills did not own any interest in the *Tribune*.

The next witness was Mr. T. C. Crawford, the Washington correspondent of the New York *World*, who gave an account of the manner in which the matter was furnished for his paper through Col. E. N. Hill. No officer or agent of the Bell Telephone Company had ever suggested or said a word to the witness about any of the articles sent to the *World*. He did not know until it had been developed in the committee room that the article had also been sent to the Bell people. He did not know a single official connected with the Bell Telephone Company, and knew of no money being paid to the *World* or any one connected with it for any articles published in the *World* concerning the matter. He said that the reason why the articles were held in the *World* office for over three months was because the editor was anxious to verify the facts contained therein and be absolutely certain before he printed them.

A number of prominent men were before the committee on April 30. Speaker Carlisle, Mr. Randall, Mr. Hewitt, Mr. Beach and Mr. Payne, of New York, were the witnesses. They followed Mr. Upshaw, Chief Clerk of the Indian Bureau. Upshaw was the local agent of the Pan-Electric Company in Alabama. He testified as to the amount paid by him to the parent company for the Alabama privilege, but declined to give any particulars as to the sale of stock or management of the affairs of the local company. The witness lost his temper several times, and once burst out with an attack upon Mr. Ranney, calling him a coward because he insisted upon asking certain questions. The first witness after him was the speaker of the House. He gave to the committee a letter which J. Harris Rogers had sent to him, saying that he had been elected a director in the Postal Telegraph Company, and that $100,000 of the stock had been placed to his credit. Mr. Carlisle read his answer to that letter, which his secretary had been able to recover from his old note-book. After Mr. Carlisle had read this letter, declining the stock, he left the witness-stand. He was not questioned beyond this except as to his knowledge of any Postal Telegraph bills pending before Congress at that time.

The testimony of Messrs. Randall, Hewitt and Beach was merely for the purpose of confirming what has already been brought out. Mr. Beach was offered $10,000 of the Postal stock by Dr. Rogers and promptly returned it. Mr. Randall did not remember ever having any stock offered him, but he had no doubt that Dr. Rogers had written him a letter making him an offer to go in with him. If such a letter had been written his reply would have been a declination as a matter of course. Mr. Hewitt corroborated Dr. Rogers story of the attempt of the Pan-Electric people to get him into the enterprise. Gen. Atkins had given him the first invitation. Hr. Hewitt described the interview that he had had with the Pan-Electric people, which was similar to the accounts already given by Dr. Rogers.

The new feature of the examination was the testimony of Mr. Payne, of New York. He testified that he was a member of a sub-committee of which Casey Young was chairman and which visited the Hot Springs in Arkansas. On that trip Casey Young offered to put him in on the ground floor for a block of his Pan-Electric stock. The stock was to cost him nothing and he was to be subject to a pro rata assessment with the rest. Mr. Payne declined to go in. He thought that it would be going into a lawsuit in spite of Senator Garland's opinion. All the public men examined on the 30th plainly showed that they thought accepting the stock by officials under all the circumstances was a grave impropriety.

Prof. Nipher's Charges against Mr. Van Benthuysen.

We have received the following from Mr. Van Benthuysen, with a request for its publication:

NEW ORLEANS, April 26, 1886.

Prof. Francis E. Nipher, Washington University, St. Louis, Mo.:

DEAR SIR: I have read your article in THE ELECTRICAL WORLD of April 24th, and if you had made yourself acquainted with the facts with reference to the subject of which you write, you would not have made the many serious errors and libelous statements contained in that article, which will no doubt reflect upon you with those fully acquainted with the facts, which are entirely different from what you represent them to be.

When the record for the defense was made up here in the suit of the "Bell Co." against the "National Improved" we used nearly all the papers presented to Secretary Lamar, together with a large number of other affidavits and proofs. I did not put your affidavit in our record here, because you notified me that you could not furnish me with the Fig. 7 instrument with which you said you had succeeded in transmitting speech, and because we have the right to use in defense what we please.

I notified the Bell attorneys that your affidavit would not be in our record, before the record was printed or delivered to them and long before the suit was commenced, and took care to do so in the presence of our Brazilian consul and Clerk of our Supreme Court, so that the attempt of the Bell attorneys to make it appear that the record presented to Mr. Lamar had been presented here to the court in a mutilated condition was a trick on the court to create a sensation without any foundation, and both the judges made disparaging comments on Mr. Storrow's statements, and one of them upon your affidavit as insulting to the courts, and I filed an affidavit, giving as a reason why your affidavit was not used by me was because Mr. Bell himself had stated under oath that he could not succeed in transmitting speech with the Fig. 7 without great alterations (which under the patent laws were inadmissible under the same patent), and I thought it only proper that no affidavit should be submitted with reference to the capabilities of any instrument unless accompanied by the instrument for actual test in court.

You must be aware that I had a right to put in or leave out anything I chose; I was not obliged to use any particular affidavit, and certainly no person would use an affidavit detrimental to their interests when the instruments sworn to could not be produced, and more particularly as many affidavits have been made about instruments that were sworn to as exact productions under patents when it was afterwards found that alterations, to insure success, had been innocently made, which would not be permitted under the patent laws. In other words, the changes made from subsequent knowledge produced instruments not covered by the patents.

You are also in error with regard to your statement with reference to the working of Fig. 7 instruments in court here. It was not done. The Bell attorneys stated that they had gotten a young man in town here to operate a set they produced and a set of improved Fig. 7 we had produced one night, and they took good care not to notify us or any of our attorneys, and there was no one present except themselves, and as I have no confidence in their statements, and as it was not done in the court or in the presence of any one appointed by the court, I attach no importance to the statements that they had operated these instruments, nor to any other statements they make unless corroborated by actual proof.

You are also mistaken with regard to what was done about using the Reis instruments. We had them all in court and were fully prepared to put them in successful operation, and repeatedly requested the court either to appoint a time to have them tested in court or to appoint

a master for that purpose. *This was opposed by the Bell attorneys*, and the court stated that there was enough evidence in the affidavits to establish the fact that they would work without making the practical tests. You must understand that this case is only an application for a preliminary injunction so far, and not upon its merits.

After giving you these facts I think it due to yourself, and those mentioned in your article, that you should correct the wrong impressions you entertain and may have created by that article. I shall send a copy of this to THE ELECTRICAL WORLD.

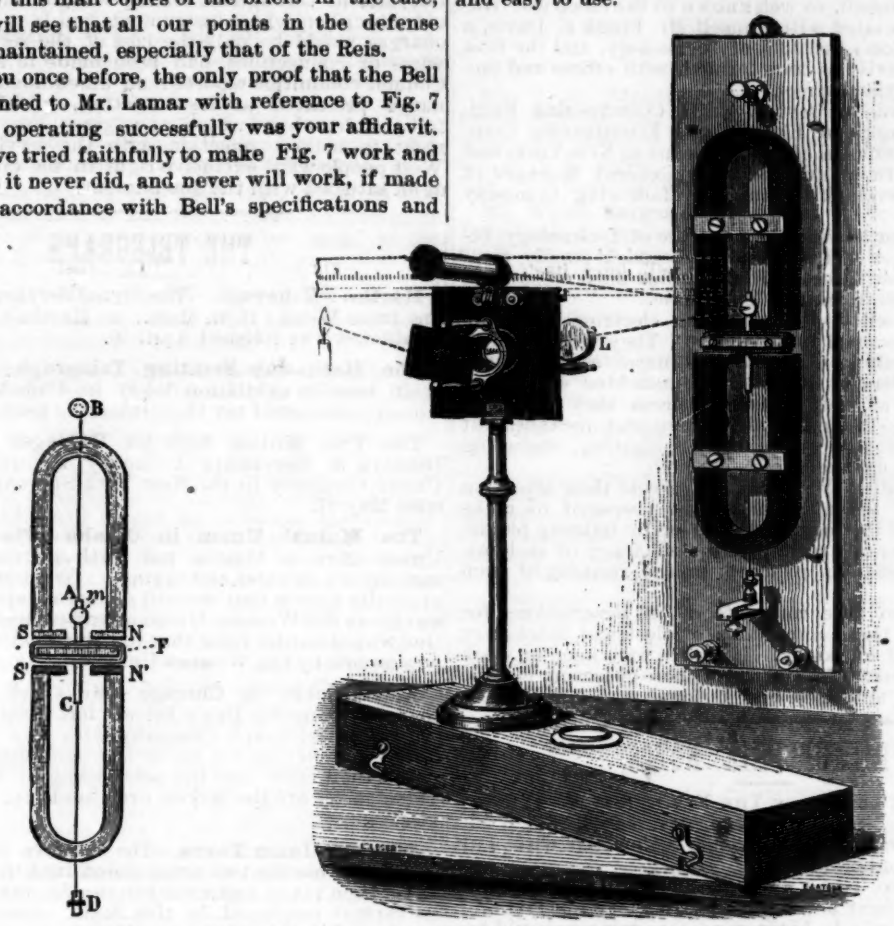
I send you by this mail copies of the briefs in the case, in which you will see that all our points in the defense were strongly maintained, especially that of the Reis.

As I wrote you once before, the only proof that the Bell attorneys presented to Mr. Lamar with reference to Fig. 7 of Bell's patent operating successfully was your affidavit. Our experts have tried faithfully to make Fig. 7 work and they swear that it never did, and never will work, if made and operated in accordance with Bell's specifications and with the state of knowledge only existing at the date of his 1876 patent, and I desire to add that the non-use of your affidavit in our suit here was brought before the investigating committee in Washington last week and the false statements by the Bell attorneys with reference to its non-use here were fully exposed and shown to the Investigating Committee, although it was a matter totally irrelevant to the resolution of Congress under which that Committee was acting.

I regret to find, after all your assaults upon the Bell patents, an article from you, written, it would seem, in the interest of the Bell Company, upon subjects of which you knew nothing.

A large number of German publications printed from 1860 to 1865 contain accounts of the transmission of words and articulate speech by Philipp Reis with electricity, and the instruments as made by Reis do now transmit and receive articulate speech clearly and distinctly, and I maintain that if only five words were so transmitted the discovery of its being done with electricity by Philipp Reis is conclusive, and that no honest or intelligent person can concede to Bell what was done and given to the world unconditionally 15 years before by Philipp Reis. All subsequent efforts are merely mechanical improvements, and no honest man acquainted with the subject can dispute the discovery by Philipp Reis. Very respectfully,

W. VAN BENTHUYSEN.



FIGS. 1 AND 2.—NEW D'ARSONVAL GALVANOMETER

Improvements in Galvanometers.

At a recent meeting of the Physical Society of Paris, M. d'Arsonval described a new galvanometer devised by himself, which he employs in the study of animal heat; but the modifications which he has introduced are likely to be of general utility. He has invented a micrometric scale which renders it possible to increase the sensitiveness of a mirror-galvanometer to any extent. He has recourse to an optical method, which bears entirely upon the process of reading off without increasing the inertia of the apparatus.

The process of Poggendorff, generally employed, consists in fixing a plane mirror to the movable portion of the galvanometer, and examining the image of the graduated scale through a telescope. He obtains thus an image smaller than the scale, which is then magnified by the eyepiece of the telescope.

The sensitiveness is not proportional to the distance, since the image becomes smaller and smaller the further it is removed.

Dr. d'Arsonval, whose arrangement is shown in the accompanying engraving, Fig. 1, uses a scale in twentieths of a millimetre, photographed on glass, and illuminated by means of a lens or mirror. A lens gives a magnified image, which, after reflection in a second mirror, is still further magnified by means of a second mirror furnished with a wire grating. The inventor substitutes for the plane mirror, not easily obtained, a concave mirror silvered on its posterior surface. He takes a plano-convex lens, silvered at the back, which thus forms a concave mirror giving a perfect image which can bear magnifying to 100 diameters; the sensitiveness of the apparatus is increased in the proportion of the magnifying power. Hence it is possible to read the slightest deviations with great precision, which renders the galvanometer both proportional and easy to use.

By a very simple arrangement this apparatus is transformed into a Carpentier's transparent scale. To this end a wire extended vertically is substituted for the micrometric scale, and for the eye-piece a graduated scale of celluloid, as is represented in the figure. The lens *L*, placed in front of the micrometric scale, answers a double purpose; it increases the clearness of the image, and, as it is movable, we may, by simply sliding it, alter the magnifying power of the apparatus.

The arrangement being placed at 1.20 metre from the galvanometer, a displacement of the image equal to $\frac{1}{40}$ millimetre, or an angular deviation of $\frac{1}{100}$ of a degree of a circle, can be distinguished. The diagram, Fig. 2, shows the galvanometer in detail. Between the poles of the magnets there is placed a piece of soft iron, which concentrates the magnetic lines, and around this core there moves the galvanometer coil, which consists of a single turn of a metallic strip built up in two halves of copper and of German silver. The wire *C D* is connected at its lower end with the spring *D*, and at its upper to the terminal *C*.

Electric Lighting in Denver.

The city of Denver stands almost alone in this country in the matter of street lighting. Both arc and incandescent lamps are used in a combined system under one management. Another peculiarity consists in the fact that the Brush company is running Edison lights. For arc lighting, the Brush system is used. There are six towers, on each of which are six 3,000 c. p. arcs, and on another tower are four 3,000 c. p. lights. Besides these are seven masts, each of which carries a 3,000 c. p. light. This alone would give a good light, but in addition each of the 500 lamp posts that once held a dim, flickering little jet of gas is adorned with a 20 c. p. Edison lamp. The result is eminently brilliant and pleasing. The cost of the service is anything but large. The bid of the gas company was $35 a year per street lamp, whereas the incandescent lamps are furnished at $28. The arc lights cost the city $150 for each mast; $960 for the tower with four lights; and $1,296 for a six-light tower.

Supplementary to the city lighting, the local company has 300 private lights in use, at $13 a month for 10 o'clock lights, $15 for 12 o'clock, and $20 for all night. The station is run by three engines—one 250 h. p., made by Wm. Wright, of Newburgh, N. Y.; a Corliss of 166 h. p., made by Fraser & Chalmers, of Chicago; and a 50 h. p. from Hendey & Meyer, of Denver. The capital of the company is $200,000. Mr. W. B. Rundle, a well-known electrician, is the superintendent, and Mr. R. H. Sterling is the electrician. The company is evidently doing a good business, and there is a project of forming two companies, with two plants, one to attend to the arc lighting and the other to handle the incandescent lighting.

Legislation on the Telephone.

In his latest news circular to the members of the National Telephone Exchange Association, Gen. Barney, the secretary, has these notes:

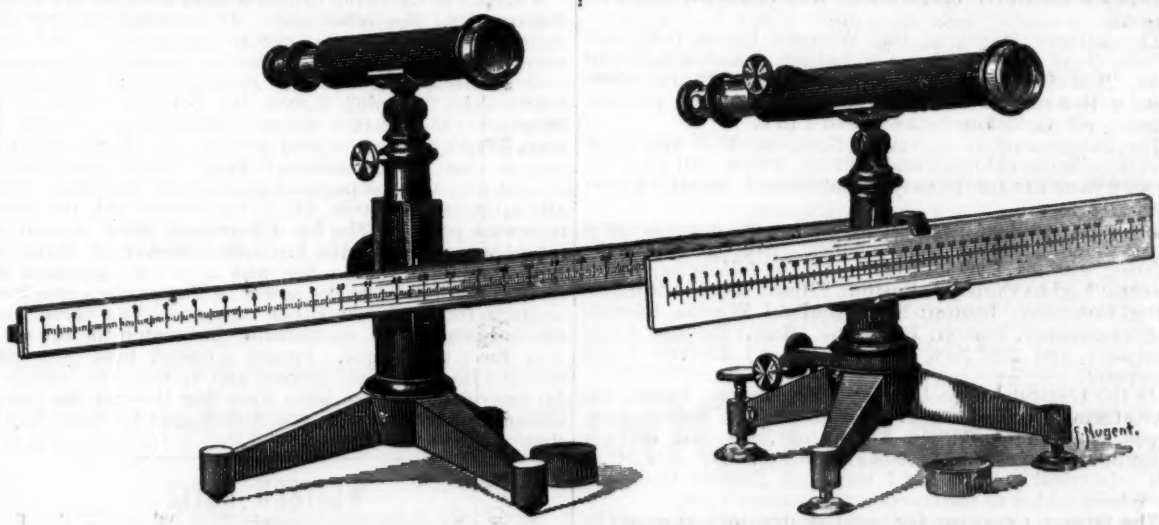
The following is an extract from the "privilege tax" law passed by the Mississippi Legislature last month, and in force from April 1, 1886:

On each telephone company (annually), $25; and in addition thereto on each telephone exchange with 25 or less subscribers, $5; on same with more than 25 subscribers and less than 50 subscribers, $10; on same with 50 subscribers or more, and less than 75 subscribers, $15; on same with 75 subscribers or more, and less than 100 subscribers, $20; on same with 100 subscribers or more, and less than 150 subscribers, $30; on same with 150 subscribers or more, and less than 200, $40; on same with more than 200 subscribers, $50. And this shall be in lieu of all other taxes of telephone companies and telephone exchanges.

A bill has been introduced in the Ohio Legislature requiring all foreign telephone and telegraph companies operating in that State to return their gross receipts for taxation. There is also a bill before that body the object of which is to tax all telephone, telegraph and electric light companies operating in the city of Cincinnati, two dollars per pole per annum for all poles in use by such companies.

Reading Telescopes for Mirror Galvanometers.

Our illustration represents two forms of reading telescope adapted for observing the deflections of mirror instruments. They are provided with means of adjustment for raising the line of sight and shifting the scale. The latter is of glass finely ruled, and is not subject to variations according to the hygrometric state of the atmosphere, so that the indications are always reliable. Both these instruments, which are made by Messrs. Hartmann & Braun, of Frankfort, Germany, have been imported by Messrs. Queen & Co., of Philadelphia.



READING TELESCOPES FOR MIRROR GALVANOMETERS.

The Western Union Company in California.

Although the Western Union Company is called a monopoly, it hardly deserves the name, except so far as the Pacific Coast is concerned, the competition in nearly all other parts of the country at the present time being active. On the Coast, where the company reigns undisturbed, however, there are 600 Western Union offices, but the receipts for the entire Coast are less than those of the Chicago office, and less even than the receipts of the Broad street office in New York. The company has 10,823 miles of poles and 20,284 miles of wire, the figures affording a good indication of the sparse manner in which the vast region is settled. The whole business is carried on in a very

unpretending style. The San Francisco office employs 37 operators, but will want more if business improves at recent rates of progress. There was an increase for February of 40,000 messages. The average total number of messages sent daily is 7,000. Los Angeles has about 10,000 messages a month and Sacramento about 6,000. Stockton does in the neighborhood of 1,500 monthly. There are about twenty branch offices in San Francisco. It is claimed that the operators' salaries are a little higher on the coast than they are East, while the value of money is, roughly speaking, the same. The lowest salary is $50 a month and the highest is $100.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, May 3, 1886.

Evidently there is no question at to the efficiency of a good automatic fire alarm, and I think the subject might be profitably taken up by the insurance companies. It is said that there are now two or three good systems awaiting approval by the authorities, who ought to lose no time in acting upon them.

The last of the series of kerite cables supplied by Mr. Clark B. Hotchkiss to the American Telegraph and Telephone Company to cross the Hudson, was laid on Saturday, May 1. The whole work has been done in very good shape, the cables give splendid results, and the company, through Mr. Fairbank, its chief of construction, is understood to be very well pleased. In a brief week or two it will be: "Just excuse me a minute while I talk to Brown in Philadelphia over the telephone," or "I'll attend to that just as soon as I have answered this telephonic call from Boston."

The Continental Electric Company, 71 Broadway, have patents on various systems of telegraphy and synchronous movements, attention to which was called lately in the WORLD. I have called at their office a number of times and have seen their electric clock in operation, employing the movement, with a pendulum at the bottom of which are four magnets divided into sections of two each to impel the pendulum. The clock has kept correct time since it was put up six months ago.

The National Tube Boiler Company has moved from 64 Cortlandt street to 36 Cortlandt, second floor, where Mr. Caldwell will be glad to meet electric light men and others desirous of purchasing a good tube boiler.

I hear that the Wallace Telephone Company of this city has received a franchise for Indianapolis, Ind., to be used by a local company. It remains to be seen what can be done with it. The Wallace Company claims to be meeting with great success in Ottawa, Can.

The New England Telephone Company held its annual meeting to-day at the Metropolitan Telephone Company's offices, for the election of officers and directors. The President is General Sherwin; the Vice-President, Mr. H. S. Hyde, who are directors with Messrs. Wm. H. Forbes, C. P. Bowditch, T. N. Vail, F. Ayer, M. G. Parker, S. Saulisbury and B. C. Deane.

Mr. William Fix, 169 Fulton street, the old manufacturer of messenger call boxes, is back to business after a severe illness of several weeks. He is prepared, as of yore, to manufacture all kinds of specialties, particularly for the messenger call systems. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., May 3, 1886.

The New England Telegraph and Telephone Company will pay a quarterly dividend of five cents per share on May 15.

The delivery clerks of the Western Union Telegraph Company, of this city, have organized a strong base-ball nine. The club played its maiden game last Friday afternoon with a picked nine composed of old-time players, coming off victorious by a score of 7 to 0.

The Baltimore & Ohio main office, cor. Milk and Arch streets, is being enlarged and refitted, which will give increased facilities for quickly dispatching a rapidly growing business.

The Whittier Machine Company of this city manufactures a very reliable and serviceable boiler. Among the electric lighting stations having it in use are the following: Brush Electric Light Company, Boston; Edison Electric Illuminating Company, Boston; New England Weston Electric Light Company, Boston; Brookline (Mass.) Electric Light Company, and the New Bedford (Mass.) Electric Light Company.

At the Institute of Technology a Sophomore league has been formed consisting of the Electricals, Mechanicals, Civils, Architects and the Laboratory, the last being a consolidation of the chemists and mines. Mr. A. L. Russell (electrical supplies) and the Hall Rubber Company have been added to the co-operative society's list.

The Edison Company for isolated lighting, through its New England agents, Messrs. Paine & Francis, has received an order for an increase of its plant in the Nonantum Worsted Mills, at Newton, Mass., from 500 to 800 lights. The same company has just finished putting in wires at the Victoria Hotel, this city, preparatory to the installation of a plant of 300 incandescent lights.

The Sun Electric Light Company, of Woburn, Mass., has introduced its high-tension incandescent distribution apparatus on the Brush Electric Light Company's circuit in this city. The first of the several distributing boxes ordered by the latter company was placed in position in the Rogers Building on Washington street last Saturday. Those interested in electrical improvements will find themselves amply repaid for the trouble of a visit to see the Sun Company's remarkable apparatus, which is an admirable combination of electrical ingenuity and mechanical skill. Mr. Frank Ridlon, of the Brush-Swan Company, has also an interesting article on exhibition in the same office which consists of a multiple series cut-out.

Advices from Lowell, Mass., April 30, give the annual report of the Erie Telegraph and Telephone Company—just issued—as follows: Total earnings, $521,001.32; total expenses, $351,151.55. There is $22,184.18 charged to construction, leaving net earnings above all disbursements of $147,665.59. The net gain over last year in net earnings above all disbursements is $12,532.34. The capital stock issued and entitled to dividends is $4,800,000. Total amount expended in reconstruction, repairs, rebuilding, construction and general improvement of the plant included in the statement, $74,245.66. The assets are set down at $5,479,913.25, and liabilities at the same amount. Among the assets licenses are credited with $2,342,965.97, plant with $2,350,000, treasury stock with $200,000 and construction with $413,861.10. The cash on hand is $1,917.90. The capital stock is a liability at $5,000,000, and profit and loss at $377,451.98. Construction has been credited the amount received from the syndicate on account of the Southwestern Dakota Telephone Company and Arkansas Telegraph Company purchases, as the total cost of these properties was originally charged to this account.

A new electrical enterprise has been started in Boston. Mr. Fred. M. Kimball, so well known to the electrical fraternity, has associated with himself Mr. Frank E. Davis, a graduate of Boston's Institute of Technology, and the firm of Kimball & Davis has been formed, with offices and factory No. 160 Portland street.

Mr. Kimball was for several years Constructing Engineer for the American Electric and Illuminating Company, until the removal of said company to New York, and afterward Electrician and Assistant General Manager of the Electrical Development and Manufacturing Company of this city.

Mr. Davis, after leaving the Institute of Technology, became the manager of a well-known electrical supply company, which position he creditably filled until embarking with Mr. Kimball in the new enterprise.

The new firm will style themselves electrical and mechanical engineers and constructors. They will make a specialty of installing small isolated incandescent plants for hotels, residences, factories and machine shops, and as an important adjunct to their business they will give their attention to the installation of arc and incandescent plants complete for central station lighting, including boilers, engines, dynamos, etc., etc., etc.

Messrs. Kimball & Davis will also devote their attention to fine electrical testing, and will be prepared to make complete tests of the machinery of electric lighting plants, and to furnish reports regarding the efficiency of systems, and giving suggestions required in the running of such stations.

They will also take contracts of all descriptions for wiring, and for the manufacture of electrical machinery and apparatus of all kinds. The firm will keep in stock all supplies necessary for the use of those operating electric lighting, power, and telephone stations. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, May 3, 1886.

Mr. E. F. Ingraham is no longer connected with THE ELECTRICAL WORLD.

Springtime has come and the frost is all out of the ground, yet we hear nothing of the great "underground" campaign that was to begin as soon as winter should betake himself to his hyperborean home. The aërial lines sing gently to the spring breezes, the kite tails dangle as gracefully as ever from their favorite wires, and no one says one word about underground. It would seem that those people who last winter were just dying to bury their wires, when the weather should permit, did not accurately express the faith that was in them.

I have just had the pleasure of seeing Partrick & Carter's new catalogue of annunciators, bells, alarms, etc. It is, without doubt, one of the most complete, if not the completest, catalogue of the kind published. It embraces a number of novelties and new applications, as well as all the standard goods of the firm. I understand that Partrick & Carter have lately secured several new patents, and have others pending. Their "return call" annunciator is meeting with great favor all over the country. They combine enterprise with thoroughness in a remarkable degree.

A stroke of lightning caused a most peculiar fire in Harrisburg, Pa., the other day. It occurred on top of a church steeple and was therefore too high for the usual fiend to claim that it was due to the crossing of the steeple with an electric light wire. During a thunder-storm and heavy rain, lightning struck the extreme point of the steeple of the Market Square Presbyterian church, the most lofty edifice of its kind in that city. On the top of the steeple was an ornamental knob which immediately caught fire, and the peculiar position of the blaze naturally attracted attention, filling the streets and the house-tops with people. The fire department tried several different ways to reach the fire with a stream of water, but without success. The fire was over two hundred feet from the ground and the power of the engines was inadequate to force the water that distance. For three hours the firemen could do nothing but watch the fire eat its way down the steeple. Finally a line of hose was taken into the interior of the church and up into the steeple as far as possible. Then holes were dug through the steeple, through which the hose was drawn, and in that way the flames were extinguished.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, May 1, 1886.

Mr. Forée Bain, who is well and favorably known to the electrical fraternity west, is opening an electrical establishment at 95–97 East Indiana street, Chicago. Mr. Bain will make a specialty of manufacturing to order and repairing all kinds of electrical apparatus, and his qualifications for this work and the equipment of his shop are of the very best. Mr. Bain himself is an expert electrician, and he has a large quantity of brand new machinery, specially adapted to the purpose for which it will be used. All such work as repairing dynamos or other electrical apparatus, manufacturing new inventions, specialties and novelties, will receive prompt attention. Besides the above, Mr. Bain will carry in stock the most important lines of electrical goods, and will undertake to fill satisfactorily orders for anything electrical. As electrical engineers, the firm will contract for the erection and equipment of electric light installations, telegraph and telephone lines and fire alarm plants. Electric bell, annunciator and gas lighting work is accepted, and electrical construction work of any kind undertaken. Services of experts will be furnished patrons. Such an establishment as Mr. Bain's has been needed in Chicago, and it will undoubtedly receive substantial encouragement from the start.

The employés of the Western Electric Company who, some days ago, made a request for shorter hours, are hereafter to work only nine and one-half hours daily, their pay remaining the same as before. This is a reduction in time of half an hour per day.

The Indianapolis telegraphers gave their annual reception Monday evening last. It was largely attended, and proved to be an enjoyable affair. Chicago, Cincinnati and St. Louis were represented.

The telephone matter in Indianapolis appears to have quieted down somewhat. President Phillips, of the Central Union Company, appeared at last session of Council and made a statement, claiming there was a misunderstanding between the city officials and his company. He said, in reference to their withdrawing, that it had been decided upon after consultation, and the effort to establish toll stations throughout the city was to accommodate their old subscribers whose instruments had been removed. The charges would be only the cost of the service. No new wires or connections had been made in so doing. The Council committee reported an amendment to the ordinance presented at last meeting, granting the West folks a franchise which now gives any telephone the right to make connection with the service lines. The West people want exclusive right in the city, and are not at all satisfied with the amendment. W. A. K.

THE TELEGRAPH.

Martha's Vineyard.—The Signal Service cable and land line from Wood's Holl, Mass., to Martha's Vineyard and Nantucket was finished April 30.

The Hathaway Printing Telegraph apparatus has again been on exhibition lately in Philadelphia. Those who are interested say they intend to push it.

The Two Million Suit for Damages brought by the Bankers & Merchants' Company against the Western Union Company in the New York Supreme Court will be tried May 17.

The Mutual Union in Omaha.—The local Mutual Union office in Omaha put forth a circular last month, announcing its rates and saying: "We desire to make it generally known that we will render as rapid and accurate service as the Western Union or any competing company." One would hardly infer that the Mutual Union Company was owned by the Western Union.

Kerite Cable for Chicago.—Mr. Clark B. Hotchkiss, General Agent for Day's kerite, has furnished the Western Union Telegraph Company with two cables, each of ninety conductors, for use in Chicago, under ground, between their office and the new Board of Trade building. These cables are the largest ever made for telegraph service.

Western Union Taxes.—The Western Union Telegraph Company has for two years maintained that it should not have been taxed under the corporation tax law, except on its capital employed in this State. Comptroller Chapin has forced it, however, to toe the mark. Since then Senator Reilly's bill has been reported favorably, requiring the State to refund to the Western Union Company the excess of taxes it claims it has paid by being taxed on $80,000,000 of capital.

Kansas City.—It is said that the Pacific Telegraph Company, of which Mr. E. L. Martin is President, and Mr. G. M. Myers, Secretary, has been cutting rather extensively into the business of the Western Union Company at Kansas City. The new company has connections with St. Louis, Chicago and Omaha. Mr. W. H. Woodring, for many years chief operator in the Kansas City Western Union office, has been transferred to another office, making room for a new chief from St. Louis.

Telegraph Poles as Mile Posts.—The Union Pacific Railway Company has adopted the novel and useful plan of turning the telegraph poles along its tracks into mile and half-mile posts. The work is now going on. The poles will be set with reference to distance, and each mile and half-mile post will be conspicuously numbered. The advantages of the system to the railway employés, telegraph linemen, passengers, and even the people living along the line, are obviously many, and the company is to be congratulated on its action.

Signal Service Reports.—Without any previous notice, the Signal Service Bureau began May 1 the compilation and publication of its weather predictions on a new plan, which, it is believed, will meet with general favor. Instead of announcing what the weather is likely to be in the various geographical divisions of the country, as the New England States, the South Atlantic States, etc., the predictions will hereafter be made for each State, grouping together, from day to day, such States as are likely to have the same weather. Whenever necessary, predictions will be made for different portions of the same State. The first bulletin sent out, for example, showed a probable difference in the weather of Eastern New York and Western New York. The Signal Service officers say that the average man will more readily understand and appreciate a prediction applied to his State than one concerning a group of States, and the new plan will, they think, prove popular.

The Latest News Scheme.—A corporation to be known as the Press News Association has been formed in this city by Albert B. Chambers, Francis W. Jones, Dwight Townsend, Edward S. Stokes and Robert G. Ingersoll, with a capital of $10,000, with which it is intended that the association shall be employed in "receiving, obtaining, collecting and accumulating items and matters of news of a financial, social, business and general character, and selling, vending, furnishing, distributing and supplying the same." The association is to have an existence of fifty years and is to be "carried on in the United States and throughout the world," although the principal place of business will be in New York. It is understood that the association is to work in conjunction with certain telegraph schemes with which Mr. Stokes is connected, and by means of private instruments supply its customers with news inside of their own houses between the times of the publication of the morning and afternoon papers, and after the latter have been issued.

A Big Suit Against the Western Union.—A motion to stay the proceedings in the suit brought against the Western Union Telegraph Company by the Bankers & Merchants' Telegraph Company to recover $2,000,000 damages, made on behalf of Gen. Edward Harlan, receiver of the American Rapid Telegraph, was heard before Judge Wallace, in the United States Circuit Court, this city, on May 1. Roscoe Conkling and Messrs. Wilson & Wallis ap-

peared as counsel for General Harlan and Col. Robert G. Ingersoll and Edward Lauterbach represented the Bankers & Merchants' receiver. Mr. Wallis, in presenting the argument, said that his client would be satisfied if the other side would stipulate that any judgment obtained in the State court should not be used in the suit of Harlan against Farnsworth in the United States Circuit Court, which is brought to determine ownership and not damages. After Colonel Ingersoll had replied, Judge Wallace said that he could not see any reason why he should interfere in a law suit in a State court and denied the motion.

THE TELEPHONE.

The Oram System of telephonic time has been giving great satisfaction in Chicago. The service is known as "Giles' Standard Time," being furnished free through the instrumentality of Giles Brothers, the well-known manufacturers of the anti-magnetic shield for watches. The firm bears the expense with the Chicago Telephone Company, from whose exchange the system is worked.

N. T. E. A.—Arrangements have been made to hold the next meeting of the National Telephone Exchange Association, which occurs in September next, at the Southern Hotel, St. Louis. The rates will be as follows, per day: inside rooms, $3.00; outside rooms, $3.50; with bath, $4.00; on parlor floor, $5.00. Members willing to contribute papers for that meeting are requested to communicate with the Secretary at an early day.

The Pan-Electric in Chicago.—A special dispatch from Chicago of April 28 says: The Illinois Pan-Electric Telephone Company had two meetings here on Monday, the result of which will probably be the early introduction of the Pan-Electric telephone system into this city. Dr. Kossuth Morgner, the President of the company, said after the meeting that a syndicate of Chicago capitalists had been formed, which had agreed to purchase the county rights of the Pan-Electric system for Cook County. The syndicate, he stated, would form a stock company, with $1,000,000 capital stock, and only waited the result of this meeting of the State Company before completing the purchase and putting the stock on the market. It is proposed to charge $50 per annum for instruments in private houses and $75 for those in business houses. Public instruments will also be put up at convenient posts free of charge, with an automatic attachment, by which anybody may send a message for a nickel. The dropping of a nickel into its proper place acts as a call, to which the central exchange responds, putting the caller in connection with the required subscriber. The State Company elected as Directors Senator Harris, of Tennessee; E. Morgner, Kossuth Morgner, P. H. Bierman, and A. H. Huning. The two first named represent the patent association, one of its rules being that it must have at least two of its members elected in each State Board of Directors.

THE ELECTRIC LIGHT.

Albany, N. Y.—The Edison Company has contracted with the National Express Company of Albany to put in a plant.

Yonkers, N. Y.—The Thomson-Houston lights are giving great satisfaction, and it is proposed to put a tower up for additional lights in the square.

Elizabeth, N. J., likes the light so much that the city representatives have been quarreling because the uptown wards get more of the lights than the downtown.

Amsterdam, N. Y.—The capital stock of the Edison Electric Light and Power Company, of Amsterdam, N. Y., is $50,000. Mr. James Hurst is one of the incorporators.

Running at Full Capacity.—The Jenney Electric Company, of Indianapolis, has orders to its full capacity into June. The company started a fine new plant a fortnight ago at Madison, Ind., another at Martinsville, Ind., on April 29, and a third at Michigan City, May 1. The cities named are the purchasers. During the first part of May the company will start plants at Saratoga Springs, N. Y., for the Saratoga Gas Company; Greencastle, Ind., for the Greencastle Electric Light Company, and Clarksville, Tenn., for the Clarksville Jenney Electric Light Company.

A Receiver Asked for.—At Washington, on April 26, Levi B. Leiter filed a bill against the local Brush-Swan Electric Company and the United States Electric Company for an injunction and receiver. He sets out that he has invested $1,000 in the Brush-Swan Company, and that that company has become possessed of material for carrying on the business of electric lighting, etc., but that Saul V. Wiles, acting as vice-president of the Brush-Swan Company, and A. A. Hayes, for the United States Electric Company, have made an agreement by which a large amount of the property of the Brush-Swan Company was delivered to the United States Company, upon agreement that the United States Electric Company would make just and proper compensation for the use of such property; that the United States Company refuses to pay for the use of said property, but has ever since used, and still continues to use, the Brush-Swan Company's property for its own benefit, and refuses and neglects to render any account of the use thereof or to return the same to the Brush-Swan Company.

PERSONALS.

Mr. I. H. Farnham, who is well known in the telephone business, and has been connected especially with telephonic interests in Maine, has become electrician of the New England Telephone and Telegraph Company, with offices at 50 Pearl street, Boston.

Mr. W. D. Sargent, of the New York and New Jersey Telephone Company, has returned home to Brooklyn, much improved in health by his trip to the Bahamas. His face has been tanned by tropical sunshine, and on slight inducement he will switch off from a discussion on underground wires to a description of cocoanut walks, pineapples, guavas, plantains, yams, corals, sponges, and the other things that beguile the leisure of West Indian lotos-eaters—whose laziness Mr. Sargent would do well to imitate for a time.

A New Firm.—Mr. F. M. Kimball and Mr. Frank E. Davis, both of Boston, have entered into partnership and will immediately begin business as electrical experts and manufacturers. They have taken all the machinery formerly used by the late Mayo Electrical Company, and have rented a large floor just below that occupied by the company in question. Mr. Kimball will not sever his connection with the Electrical Development and Manufacturing Company until the 15th inst. These gentlemen are well known in Boston and have a wide circle of acquaintance outside the Hub. The firm begins its career under the most favorable auspices.

MISCELLANEOUS NOTES.

The Effluvograph.—M. Tommasi has brought before the French Academy of Sciences a means of obtaining all the effects of photography by the electric *effluve* or obscure discharge. His provisional arrangement is as follows: Two metal brushes placed parallel in front of one another are each connected to the pole of a Holtz machine. A gelatino-bromide plate of about the same height is placed perpendicular to the brushes, so that the sensitive surface contains the borders of the brushes, or is very near them. The current being established a few minutes suffices to obtain the image in darkness, and the image is developed by the ordinary processes. The experiment tends to prove that the *effluve* or discharge produces the same effects as the ultra-violet rays. M. Tommasi thinks there may be a connection between the two extreme parts of the spectrum, which he calls "electric rays."

Said to Have Been Killed by Electricity.—A dispatch from Pittsburgh, Pa., says that on the evening of the 26th ult. Edward Schaum was almost instantly killed at the corner of Sixth and Liberty streets. The cause of his death, the dispatch says, was an electric shock from an iron awning frame in front of Griffith's dry goods store, which by some means had become charged with a powerful current of electricity. Schaum was standing on the pavement when a newsboy fell into the gutter. He went to the lad's assistance, and as he stooped over to raise the youngster he caught hold of the awning post. That instant he fell, having received a shock that paralyzed his entire vital energy. He was picked up and carried into a drug store, but all efforts to restore him to life were unavailing. The employés of the electric light company say the accident was caused by a broken telephone wire connecting an electric-light wire with the awning.

SPARKS AND FLASHES.

A Telephonic Spring Poem.—"How is this, Herr Zwetscke? You have got your room full of oleanders and other tropical plants, and have a telephone, I see." "Well, I have been asked to compose a poem on spring, and that is why I have a telephone line to the Prater, enabling me to listen to the singing of the birds."—*Der Floh.*

Boston's Penal Institutions.—General Sherwin was examining men a few days ago for the Boston police force, under the new civil service rules. One candidate was asked what four penal institutions there were in the city. He replied promptly: "The jail, the State Prison, the House of Industry, and the Institute of Technology."

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Western Union, b 61¼, a 61⅝.

Telephone.—Am. Bell, b 160, a 160½; Erie, b 27¼, a 27½; New England, b 33¼, a 33⅝.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Oils for Electric Light Stations.—One of the most essential supplies for electric light stations is a good oil, and station managers give the subject considerable attention. It will be worth their while, therefore, to try the valve, engine and dynamo oils of the A. W. Harris Oil Company, of Providence, R. I., as the use of these various specialties is found to have a most beneficial effect on the operation of engines, dynamos and shafting. The company has already built up a satisfactory business in the electric lighting field, and is now inviting station managers everywhere on favorable terms to put the oils to the test of practical use.

Woodwork for Electrical Apparatus.—The later applications of electricity have made great demands on the skill of the woodworking craft, and to-day some of the choicest pieces of cabinet work are to be seen in connection with electrical apparatus The Union Hardware Company, of Torrington, Conn., which has very large facilities for working in wood, pays special attention to the requirements of electrical companies and manufacturers, and fills orders for quantities at the shortest notice. The company does its own polishing, enameling, ebonizing and finishing in all the different styles. Its advertisement in this issue gives a list of woods kept on hand, and shows as sample one of the push-buttons it makes.

Kidder Apparatus.—The following is a letter recently addressed to the Jerome Kidder Manufacturing Company:

NEWARK, N. J., April 26, 1886.

GENTS: Please send me a copy of Dr. Kidder's brochure, "Electro-Allotropic Physiology," also a price-list of attachments for the machine.

I have been using one of your five-post machines in a case of spinal disease with partial paralysis in lower extremities. Would say that I believe that the treatment has prevented death, with every inclination to effect a positive cure. * * * I look upon the instrument as something invaluable as a household remedial agent. * * *

I remain very respectfully yours, J. B. JOHNSON,
7 Lemon street.

Anti-Magnetic Shield for Watches.—Messrs. Giles Bro. & Co., Chicago, Ill., have received the following testimonial:

Gentlemen: Your Anti-Magnetic Shield for Watches cannot be overestimated. It is now very near eight months that I have worn my watch, and to-day it is, without ever correcting time, about one minute slow. Considering the fact that I am every day near dynamo-electric machines in our regular business, the test could not be harder. I could never have believed that the protection was so complete. In this age of electricity not only electricians, but every one who needs correct time, should have the Anti-Magnetic Shield. A good deal of practical utility as well as pleasure can be derived from a good timekeeper. At present I look upon a watch without a shield as a thing incomplete, and so it is. Very respectfully,

CHARLES J. VAN DEPOELE,
Electrician Van Depoele Electric Manufacturing Co.

Glenn's Sulphur Soap
Heals and beautifies, removes pimples and blemishes; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure, 25c., 50c. and $1.

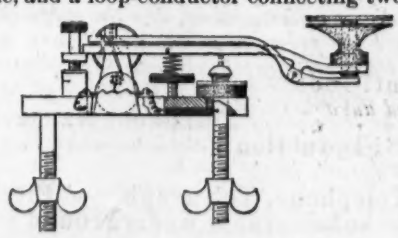
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED APRIL 20, 1886.

340,130. Quadruplex Telegraph; Joseph W. Larish, Buffalo, N. Y., Assignor to the Baltimore & Ohio Telegraph Co., Baltimore, Md. Currents of two different strengths and of either polarity are transmitted by means of the following key system: Two positive and two negative batteries or battery-sections of different strengths are employed. When the apparatus is at rest, one of the batteries of less strength is connected with the line, and when one of the keys is operated the other battery of corresponding strength is substituted therefor. The like battery-sections are coupled in series when the second key is operated, and one of the other pair is connected with the main line, according to the position of the second key.

340,134. Telegraph Key; Robert A. MacCready, New York, N. Y. The objects of the improvements are, first, to provide a key that will open and close automatically, and at the same time offer the least resistance possible to the electric current and make a perfect connection; second, to regulate the play of the key and adjustment of the spring. The general design is shown in the cut.

(1) 340,136; (2) 340,137. Quadruplex Telegraph; William Maver, Jr., Jersey City, N. J., Assignor to the Baltimore & Ohio Telegraph Company, Baltimore, Md. (1) A device is applied to the armature of the second or polarized relay or receiving-instrument, which is operated by its movement to interrupt the local circuit on the neutral relay at a second point at the moment a reversal occurs, such as would otherwise cause the said circuit to be completed, so that the local circuit will remain open notwithstanding the movement of the armature-lever of the neutral relay.
(2) Consists of a series of quadruplex-telegraph main lines and the set of instruments pertaining to one side of the same, and a loop-conductor connecting two or more



340,134. TELEGRAPH KEY.

of said sets of instruments, which conductor extends through a branch office and transmitting and receiving apparatus included therein.

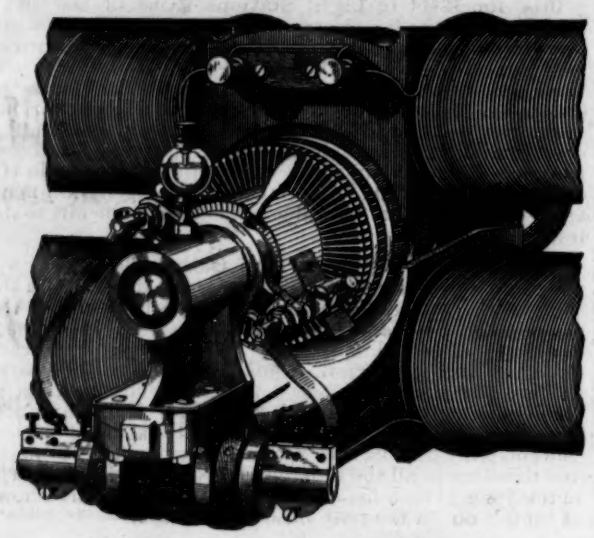
340,182. Arc Lamp; Leonidas G. Wooley, Grand Rapids, Mich., Assignor to Henry H. McGaffey, and Chester Bradford, both of Indianopolis, Ind. The lower electrode is non-consumable and the operating mechanism is therefore modified, the lamp being applicable to head-lights of locomotives.

340,203. Police Telegraphic and Telephone Station; Le Roy B. Firman, Chicago, Ill., Assignor to E. Bruce Chandler, Austin Doyle and John P. Barrett, all of same place. Embraces a sentry telephone-box having a glass roof, in combination with a lamp supported above the box, as shown in the cut.

(1) 340,395,-6-7-8-9, 340,400,-1-2-3-4. Electrical Devices; Edward Weston, Assignor to the United States Electric Lighting Company, New York, N. Y. (1) Relates to a dynamo or magneto-electric machine, embracing stationary terminals and adjustable brush-holders, and flexible conductors composed of flat copper strips united at their ends by metal plates, forming screw-clamps that are secured to studs in electrical connection with the binding-posts and the brushes respectively. The disposition is shown in the cut. (2), (3) and (8) relate to incandescent filaments. The first and second are respectively for the process of and apparatus for depositing carbon upon the ends of the filaments to form stubs, which are adapted to be retained in metal clamps. The third covers the process of exhausting gases from the filaments while cooling, and directly after carbonization. (4) A rheostat is located in a box made of wire gauze. (5) It is an improvement upon his patent 334,185, of Jan.

12, 1886. (6) and (7) relate to lamp holder and switch respectively, which consist of improvements in mechanical construction. (9) Relates to a current indicator, which consists of a disc of good conducting metal, with which appliances are connected for completing the circuit through it from the centre to several points at or near its edge. Through the centre of the disc is a perforation, and a magnetic bar is mounted close to the disc, with its two ends on the opposite faces of the same, and the cross-piece, which is at right angles to the ends, passing through the perforation. One end of the bar carries a pointer, which sweeps over a graduated scale, and the whole is inclosed in a cast-iron box, to prevent outside magnetic influences from affecting the movement of position of the bar. (10) Relates to a system of illumination of incandescent lamps in series. Around each lamp is a cut-out magnet of high resistance, having an armature that acts as a contact-maker to close, when it is attracted by its magnet, a circuit around the lamp, which circuit is normally open and contains a resistance equal to that of the lamp, and a magnetic locking device for maintaining the circuit closed through the resistance under these conditions.

340,425, 340,426. Bell Cords and Coupling; Henry B. Cox, Cincinnati, O. (1) Consists of a rubber tube and wires therein, held apart by blocks fitting in the tube.



340,395. DYNAMO-ELECTRIC MACHINE.

(2) Relates to electric bell-cords for railway cars, and has for its object to furnish a coupling for such cords of that class in which the circuit is normally open, which coupling shall be so constructed that a pull on the cord at any point will cause the coupling to close the circuit.

340,431, 340,432, 340,433. Underground Conduit; Daniel H. Dorsett, Chicago, Ill. (1) Consists of deeply-buried main conduits composed entirely of a plastic insulating material and branch conduits from the same to the buildings along the way buried nearer the surface of the street or roadway and made of iron pipes filled with an insulating material. (2). It is composed of sections each formed of an iron casing or tube with couplings, and a filling of insulating compound of coal-tar, paraffine, silicious sand, pulverized ashes and cinders, oxide of manganese, and ammonium chloride,

340,203. POLICE TELEGRAPHIC AND TELEPHONIC SIGNAL SYSTEM.

the said filling being provided with one or more passages or ducts for containing electric conductors. (3) Consists of improvements upon the first.

340,441. Automatic Alarm; Charles L. Horack, Brooklyn, N. Y. Consists of details in thermostat, combined with apparatus for automatically liberating a fire-extinguishing element.

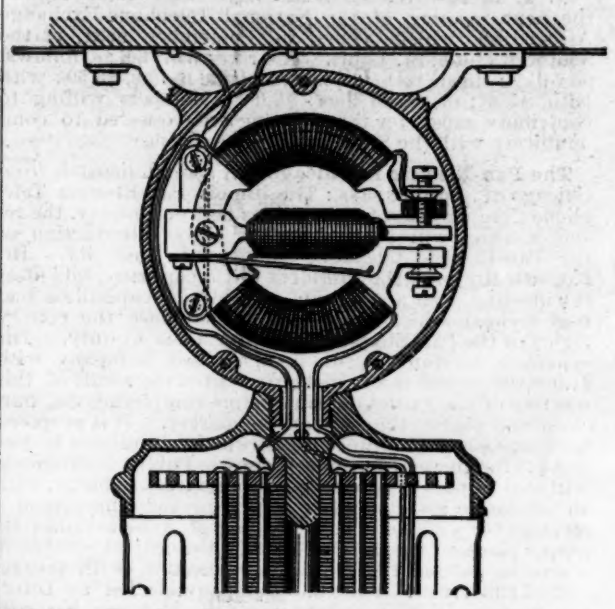
(1) 340,448, (2) 340,449. Rheostat and Cut-Out; Franklin P. Little and William H. McDonald, Albany, Assignors to Joseph A. Powers, Troy, N. Y. (1) Embraces cross-frames, having connecting wires and fire-proof electric insulating material upon their surfaces, in combination with the coils of wire wound around the ranges of connecting wires. (2) Relates to an automatic magnetic switch and rheostat whereby a resistance equal to the electric lamp or similar article is placed into the circuit instead of a lamp. In the cut the lower part represents the rheostat covered by the first patent and the upper part the cut-out.

340,460. Method of Preparing Molds for the Electro-Deposition of Metals; Lewis H. Rogers, Kansas City, Mo. Consists of first making a rigid male form approximating to the form of the article desired to be reproduced, then forming upon the outer surface of said male form an auxiliary form of wax or equivalent substance of the exact size of the article to be reproduced, and rendering the surface of said auxiliary form conductive by the application of black-lead or its equivalent, and then immersing said form in a metallic solution or bath, in which bath are placed anodes connected electrically with a suitable electro machine.

340,462. Electric Railway; Ernst W. Siemens, Berlin, Germany. Consists of details in the ordinary system of dynamos at fixed stations, and electric motors upon the cars.

340,474. Electric Battery and Means for Emptying and Recharging; James T. Armstrong, London, Eng. Consists of improvements upon patent 312,340, Feb. 17, 1885.

340,483. Electric Clock System; Julian E. Carey, New York, N. Y., Assignor to the Electric Time Co. He sends the winding impulses at frequently-recurring intervals—say once a second—and as the work required of the magnets is distributed magnets of much smaller size may be employed, and a current of less strength is



340,448. CUT-OUT INSTRUMENT FOR INCANDESCENT LAMPS.

employed. He is enabled to dispense with switching appliances at the clocks, as all of the magnets of a series of clocks may be included in the circuit at the same time and effectively energized, they individually requiring much less power than is required under the old system.

340,520. Support for Electrical Wires; Albert Potts, Philadelphia, Pa. Insulators are supported upon a chimney and wires are led into the chimney.

Short-hand Lesson Sheets, For Self-Instruction. A complete Reporter in 12 Easy Lessons. $1. Close & Black, Pub. 1338 Chestnut St., Phila., Pa.

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For experimental purposes; also Materials of all Kinds. GOODNOW & WIGHTMAN, 176 Washington Street, Boston, Mass.

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Galvanometers, Resistance Coils, Condensers, Keys, Switches, &c., Bailey Combination Set, Pratt's Speed Indicator, &c. Electric Mfg. Co., Troy, N. Y. OFFICE, 311 RIVER STREET.

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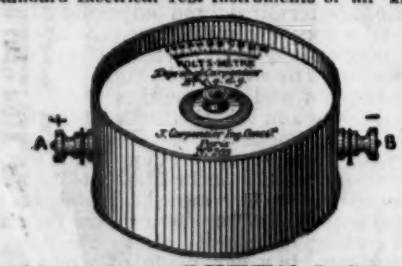

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2. Feb. 26, 1886—Novelty Imported Disque Battery, Genuine. Low special prices on quantities.
3. March 6, 1886—Novelty Hollow Base Switch. Best in the market. Send 50c. for sample, by mail prepaid. $25 per hundred; low price on large lots.
4. April 2, 1886—Fine Rod Zincs for Open-Circuit Battery. Send 10c. for sample and test against any other Zinc. $6 per hundred; $50 per thousand.
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